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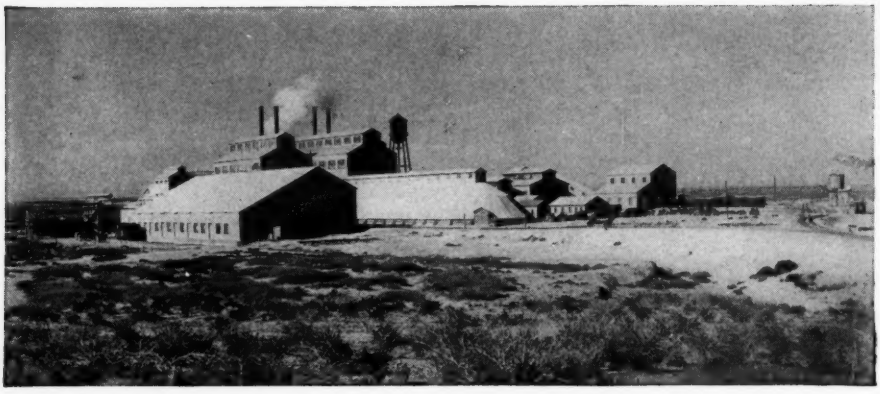

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Better Crops with PLANT FOOD

The Whole Truth — Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Offices: Investment Bldg., Washington, D. C.

VOLUME XX NUMBER THREE

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VOL. XX WASHINGTON, D. C., SEPT.-OCT., 1935 No. 3

Want a book about fairs?
Jeff says he'll write it.

All's Fair

By Jeff McDermid

BARNUM and his long train of cheerful successors in carnivals and fairs have perhaps not done as much for agriculture as Burbank or Babcock, but good old P. T. and the other purveyors of honest fun and clever sports are not without due honor in the annals of well-balanced agriculture. Hearty and wholesome relaxation has been characteristic of rural community life. This has ever been so, back in the old mother countries as well as in the pioneer and development stages of American farming.

The fine native ability of farm folks to take economic punishment at times and still bob up serenely at fall festivals, harvest homes, husking bees, and fairs has been one of the chief sources of their wonderful strength and staying power. This recurring spirit of zestful fun is an antidote against taking life too seriously. It forgets dry digits and indices and banishes curves of production, price, and income for more vibrant, amusing, and courage-building human experiences.

So the fairs of the autumn season open their gates, and we are again among the ones found gaping at the

same old mildewed stunts and the same gay deceivers that intrigued us as of yore in the times of freckles, short pants, and small change. And why not? The shut-in season is ahead of us, and there's plenty of time left to study and plan beside our winter fires. But for the present fleeting moment, let's relax along the raucous midway. What could be "fairer"?

PERHAPS I will be regarded as prejudiced, having known sundry fairs in various places from the standpoint of patron, exhibitor, judge, and reporter. Just why I remain favorably prejudiced may seem a mystery. But having survived Swedish waffles at Saint Paul, much brau foam at Milwaukee, baked beans at Springfield, Mass., and escaped hot-dog barkers everywhere on the tan-back circuit, I come through with more tolerance and original zest for fairs than might be expected from such a hardened veteran.

Anticipation, they say, is more than half the fun. As a youngster I recall how long it took to arrive at the county fair—both on the calendar itself and when the real morning dawned. How we watched the promising melons and groomed the shoats and bullocks is in itself a summer's epic or a rural elegy. Then came the moment of departure in the dewy hours, after a night of loading and preparation.

We lived twenty miles from the county-seat, and this meant starting at five o'clock to be at the fair before ten. The old dog followed us to the gate and shared with the fence-row squirrels and robins our commiseration for not being privileged like us to go forth into the wide world for a day of joy.

Frequent cardboard signs on gnarly oaks and elms or painted on lichen-covered boulders along the mellow way to town kept beckoning us onward to this paradise of pleasure. An occasional driver of a spirited team would pass us in a blot of dust, calling forth estimates of ours on how much this rural dandy might have to spend for entertainment of the lass beside him. But Father would say "easy come, easy go" and remind us that we carted precious cargo of premium-earning capacity, worth far more in the end than a day of riotous rollicking.

By degrees and with some discomfort, soon discounted, our family caravan joined others and came down the main street, like an hegira of old, to the music of Luder's silver cornet band tooting on the steps of the court house prior to the general exodus of the excited villagers to the outlying arena. If the tune, most likely, was "Hot Time in the Old Town Tonight," our Father's wit would jerk to the surface with the remark that it was ninety in the shade already and he wasn't tempted to stay until evening. But as we passed the elevated dance pavilion, decorated with straggly evergreen boughs, it made some of us chaps in the upper teens feel daring enough to bust all official regulations and be a night-hawk until half-past nine—or even worse!

WHICH reminds me that one time it was the privilege of Brother and myself to be "lent" by our Mother to serve as night watchmen extraordinary at a food and lemonade stand set up during the fair to catch the nickels of the members, and otherwise, belonging to a church aid society. We did not get to any shin-dig in town, but we found out a lot about the wild man of Borneo and the bearded lady during their leisure hours. I also recall that the mosquitoes refreshed themselves at our caravansary more liberally and economically than the customers did by day.

Resuming our eager drive to the park, it seemed that the last height in

the zenith of anticipation was reached when we got to the wooden arch gate and had to remain in line while Jeb Harris and his assistants checked over the season tickets we held and O. K.'d our final entrance into that haven of delight, whose varied sounds came over the planks in a crescendo of magnificent promise. From then on the day was yours, and the delights thereof are now a memory.

Judging at fairs is either an act of heroism, an evidence of super-discernment or an emergency bluff. My

service as a judge puts me in the last-named class because there were no others present at the time willing to stick out their necks. I had always yearned to wear an official badge and be escorted around in conspicuous places, but I did not get the judicial job for which I imagined I was most qualified, cake-eating culinary referee.

They pressed me into service, of all places, at my own home fair as arbiter between wrought-up local cattle exhibitors. As if the task wasn't tough enough already, they assigned me to pick, a la catalog, the grand champion bull of all breeds! To an outsider it would have been a real heroic position to assume, but you can't get old neighbors to put you in any other role than clumsy dummox under such circumstances. And to make it still more tragic, my outbound train was late!

However, as armor, I had acquired all the stage business of livestock judges whom I had followed through manure piles all over the circuit. Standing off and squinting, smoothing backs and flanks, hesitating and returning to verify, scratching the head, folding arms and frowning, shifting leaders, reshifting tail-enders, "giving the gate," and the final arm-swinging flourish of decision—I had them all mastered. Without this keen observation of the ways of the top-notchers from college departments, I would have carried away two black eyes instead of one.

Evidences of extreme deliberation and complexity in awarding is a compliment to the owners. A man who picks his winners too prosaically and swiftly is depriving the fans of half their entry fees. Like the midway itself, the judging ring must have its tinge of ballyhooly or it descends to a mere dull educational lesson; and that comes "free" with your taxes!

Much as art, science, and mechanics have moved ahead to provide the modern fair its present galaxy of rural power and might, we know that amusements have changed but little in the glorious interim. Save for an occasional midget golf course on the grounds, the blessed mountebanks and charming charlatans, with their accompaniment of whirligigs and hurdy-gurdies, hootchy-koochies and fairies-in-the-well, cane stands, corn games, and swatting racks, still pitch their restless tents as always on the fields of rural glee.

AS LONG as they keep sober and genial, or do not pick pockets by stealth when they can do so openly and at your pleasure, these kindred care-banishing souls may have the run of any cow pasture in my bailiwick for all of me.

I know they are for the most part gypsy-like and sordid, unwashed and alien to agriculture, call farmers "hay

snatchers" and care only enough about processing taxes to be conveniently near when they are distributed. Yet try to keep a fair minus the mountebanks profitable in a corn-belt county!

High and mighty resolves to reduce agricultural fairs strictly to vivid and varied crop demonstrations, skull-blasting panoramas of erudition, and unbiased offerings of unvarnished truth have been made by better managers than we. Yet no heavy meal is complete without dessert; and nearly every farm table, as you recall, serves both pie and cake and maybe some sauce besides, to give you pleasure with your protein.

I FIRMLY believe that we get over larger and more potent doses of "do-something" because we have sense enough to let the customers relax on the midway and take time out from imbibing our laboratory lessons and our pageants of progress stuff. It sort of salts down the silage and gives the tired minds a recess.

What if young Zeke Smithers does spend a nickel to show his best girl how stout he is with a mallet? He'll keep the other ninety-five cents toward a down-payment on the mortgage, be sure of that. And maybe if he didn't demonstrate his prowess she would marry some guy from town and upset another ideal farm romance, with all the commercial losses in its train. Maybe after young Billy Jones sees the two-headed calf he won't be so much abused when Dad sends him to teach the latest arrival how to drink milk from a pail.

Broadly speaking, there are two general classes of farm fairs. In the first and major group are the pumpkin shows of the tall-grass regions, the central meeting place of the rural trading territory, the simon-pure survival of the original European kind. The second group may be summed up in the phrase, "a contact with agriculture is necessary to the commercial success of a metropolis." Here we have a few of the state fairs and most, if not quite all, of the national livestock classics. Both have their own respective values and disadvantages, depending on the purpose of fairs as you see them.

Having been raised in the atmosphere of the squash circuit, I lean a little toward these annual events myself. I find advantage in a cheaper gate and more old friends to meet back there behind the horse barns, where the combines and fertilizer distributors are flashing their brilliant sheen of new steel and flare of paint to a sympathetic audience of discriminating users.

It's a great old spot to dream in a gossipy way about changes in the countryside, the incompetency of sheriffs, the tendency of taxes to go up or down but never to disappear; and also the prevalence of quack grass, blind staggers, patent medicine salesmen, and bad side-roads. And then, of course, you often get quite a lot of value out of the exhibits—if you finally get around to see them.

On the contrary, at the metropolitan farm fairs one takes his gossip by the cigar counter when somebody is shaking dice with a dizzy blonde, or else in a noisy cafe. This is too distracting for the deliberate and mellow tone suited to the proper discussion of livestock goals and values.

HOWEVER, I honestly believe that as a result of fairs held in cities many very ignorant people have really discovered agriculture — although perhaps too late. If this is so, then these transplanted fairs have rendered their part in the civilization of America.

After all, it's "the little snips," as one croaker called the 4-H youngsters, who have anchored our rural fairs to the future. I guess they *are*

(*Turn to page* 45)

Apple Trees Need A Balanced Diet

By Dr. Fred W. HofMann

Agricultural Experiment Station, Blacksburg, Virginia

SEVERAL years ago it was pointed out by the writer that apple trees in general in Virginia will at least ultimately be benefited by applications of nitrogen, phosphorus, and potash in complete fertilization. In their younger history and up to the time the roots of the apple trees become crowded, the more pronounced growth and yield responses show up as a result of nitrating. As crowding progresses, direct responses in apple trees as a result of phosphorus and, still later of potash applications added to those of nitrogen, show up to the extent that such applications may give profitable returns.

In some soils of Virginia, profitable growing of apples may be carried on for 20 to 25 years or even for the entire commercial life of the orchard without the need of applying any fertilizers other than those carrying nitrogen. In most soils of Virginia, however, as apple trees increase in size, the need for phosphatic and potassic applications increases.

Experimental Data

Many questions come up in the mind of the apple grower in regard to the more profitable way of fertilizing the orchard soil. It is the purpose of this article to show several experimental results with different fertilizer applications. It is hoped that these results will provide a definite answer to various questions that may come up.

Observations were continued on the experimental orchards of the Virginia Agricultural Experiment Station planted out in the spring of 1911. These are described in bulletin 269 and other reports appearing in the proceedings of the American Society for Horticultural Science.

In the fall of 1930 and the spring of 1931 another series of experiments were set up in a near-by orchard also set out in the spring of 1911 and known as the Price orchard. At the time the fertilizer experiments were begun, these trees were about 20 years of age. The soil in this orchard is classified as a Clarksville silt loam. It is very cherty, shows a pH reading of about 6, and except for spots is of average fertility. The subsoil, composed mostly of a tight stiff clay, is seldom penetrated by the tree roots to much over a depth of two feet.

The trees, composed of York, Stayman, and Grimes Golden successively, were planted 25 feet apart with the intention of making removal as more room was needed. In their earlier years the trees made good growth, but by the time they reached 15 years of age very little growth was made because of the close planting. This slowing up of growth and general stunting of the apple trees, particularly because of close planting

and root competition, provided excellent material to show what fertilization will do to stunted trees in contrast to those on the station grounds which, because of wider planting distances, were in a better state of growth.

Rate of Growth

In some cases covering 21 years, the treatments receiving nitrogen alone show growth gains over those receiving complete fertilizers. In these cases the plots receiving nitrogen alone were very definitely favored in regard to position, and had at the beginning a soil of better fertility than the plots that were treated with complete fertilizers. In spite of the handicaps, higher rates of gain were made by the complete-fertilizer treatments. Over the entire 21 years, Stayman trees treated with nitrogen alone showed a total gain of 3.08 inches circumference increase, 62 per cent of which was made in the first 11 years but only 38 per cent in the last 10 years. Another set of Staymans showed a total gain of 6.55 inches with 75.6 per cent of the gain in the first 11 years and only 24.4 per cent in the last 16 years. With a similar comparison for a case in York trees there was a total gain of 4.03 inches of circumference increase for those receiving nitrogen alone, with 61.3 per cent of the gain shown up the first 11 years and only 38 per cent the last 10 years.

A higher rate of increase of the handicapped complete-fertilizer plots to the level of the favored plots receiving nitrogen alone was also observed with terminal growth measurements. Stayman with a total gain of 9.5 inches terminal growth over a period of 21 years for nitrogen alone showed 53.7 per cent of the gain taking place the first 11 years and only 46.3 per cent the last 10 years. Another case in Stayman showed over the same period a gain of 8.4 inches terminal growth for nitrogen alone, with 76.2 per cent of the gain taking place for the first 11 years and only 23.8 per cent the last.

In one case with Yorks the handicapped complete-fertilizer plot caught up with the level of the favored nitrogen-alone plots. The total terminal growth gain in favor of the nitrogen-alone plot for the 21 years recorded was 19.8 inches. This entire gain occurred in the first 11 years, after which the trees in the complete-fertilizer plots caught up with the much more favored plots receiving nitrogen alone.

The significant observation in the cases mentioned is that in the 17th and 18th years the trees treated with complete fertilizers, in spite of their handicaps, made better rates of growth than those receiving nitrogen alone. According to this rate the prospects are that they may show even better growth responses later. The most interesting observation is that the gains of the favored nitrogen-alone plots began to recede at just about the same time that the complete-fertilizer plots started to outyield the other treatment.

Root Crowding

Certain aspects of yield responses are brought out in Table I. In this table, beside the actual yields, sliding averages over a 5-year basis were computed to smooth out the yield distribution over the 17 years of records. These sliding averages overcome the abruptness in yields that occur from year to year, thus making it more possible for a smoother comparison between the two different distributions arrayed against one another.

It will be noticed that the Stayman apple trees in one series commence to show yield gains after the 14th year, in another after the 16th, and in York series after the 17th. This corresponds as a general trend with the growth responses.

TABLE I—Actual and Sliding Average Apple Yields in Pounds of Fruit per Tree

Series I—Stayman

Year	N*		Check*		NPK*	
	Actual Yield	Computed Sliding Average	Actual Yield	Computed Sliding Average	Actual Yield	Computed Sliding Average
1918	8	2	6	1	5	19
1919	0	33	0	17	0	41
1920	0	118	0	50	0	147
1921	0	179	0	79	0	184
1922	2	264	0	154	92	250
1923	155	266	82	154	111	232
1924	433	385	168	175	533	344
1925	307	391	135	198	183	388
1926	423	508	305	286	333	551
1927	10	481	0	256	0	578
1928	750	709	186	370	673	830
1929	467	573	283	343	750	710
1930	890	643	575	419	1000	763
1931	290	581	237	380	467	704
1932	1150	678	571	427	1258	783
1933	67	441	48	356	75	546
1934	817	817	663	663	1017	1017

Series II—Stayman

1918	3	2	0	1	1	15
1919	0	13	0	3	0	18
1920	0	60	0	5	0	101
1921	0	103	0	52	0	158
1922	7	241	3	86	75	249
1923	57	239	13	115	15	254
1924	238	301	10	122	417	331
1925	213	364	233	134	283	338
1926	688	476	170	117	453	466
1927	0	509	150	158	103	561
1928	368	669	48	179	400	789
1929	550	605	67	195	450	724
1930	775	675	150	318	923	907
1931	850	650	375	360	930	904
1932	800	583	258	355	1242	895
1933	50	475	125	404	75	721
1934	900	900	683	683	1367	1367

Series III—York Imperial

1918	2	2	3	25	12	91
1919	0	21	0	46	0	95
1920	0	152	0	178	0	201
1921	0	152	0	178	0	201
1922	7	220	123	286	443	285
1923	99	219	106	262	31	203
1924	656	296	660	290	530	309
1925	0	400	0	333	0	374
1926	338	489	540	362	423	479
1927	5	629	4	404	29	481
1928	483	666	248	433	563	704
1929	1175	727	875	489	856	642
1930	448	511	141	350	525	651
1931	1038	527	753	400	430	682
1932	188	356	150	286	1144	767
1923	788	441	550	354	266	578
1934	94	94	158	158	900	900

* N = Nitrogen; P = Phosphorus; K = Potash; Check = Unfertilized.

Much quicker responses in both growth and yields occurred in the Price orchard. (See tables II, III, and IV.) These results are interesting in showing how quickly some apple trees may respond directly to complete fertilizers. Where it has taken about the 15th year for apple trees in the experimental orchard to begin to show responses to complete fertilization, marked response occurred in the apple trees in the Price orchard within three years.

The results of the experiments at the Station orchard and the Price orchard show clearly and definitely that under certain conditions apple trees are not entirely different from other plants in responding to complete-fertilizer applications. Direct effects in heavier and larger fruit buds were observed the late fall of 1931 following the spring application of that year.

It would appear that most of our Virginia orchard soils contain phosphatic and potassic material in adequate amounts to take care of apple trees through their entire commercial life. In some instances this is the case, but the point that may be overlooked is that in most Virginia apple orchards these materials become increasingly inaccessible as the root systems of the apple trees develop and displace soil in a limited space. Such trees become something like "pot-bound" plants with the root systems confined to a restricted area. (See plate I.) Apple trees reaching a physiological limit may draw upon their reserves to such a degree that they are liable to become susceptible to various stages of decline. This pulling away of the plant's stored reserves may continue some time without any discernible symtoms. However, there may be present the danger of hastening definite symptoms of nutrient deficiency. Such symptoms as die-back, greater susceptibility to wood rots, and leaf scorch have been observed to develop under such conditions. It is of particular interest to review here the statements of Hoagland and Chandler in the following quotation: *

*Some effects of deficiencies of phosphate and potassium on the growth and composition of fruit trees, under controlled conditions. Proc. Am. Soc. Hort. Sci. Hoagland, D.R. and Chandler, W.H.

Plate I—Where formerly there was soil, there is now a mass of crowded roots. Most of the apple trees in Virginia over 15 years of age are root-crowded. Root-crowding of these apple trees not only presents a problem of depleted nutrients in the soil that is left for root foraging, but also a problem of soil displacement. As this root-crowding increases with the age of the trees, further development is checked unless the necessary nutrients such as nitrogen, phosphoric acid, and potash are adequately replenished.

TABLE II—AVERAGE ANNUAL YIELD PICKED FRUIT 1932-1933-1934

Dean Price Orchard

Row	Bushels per tree: Grimes	York	Stayman	All Varieties	Treatment
1	1.23	1.07	1.65	1.32	Calcium Cyanamide 5 lbs. Fall
2	2.43	1.39	1.27	1.65	Calcium Cyanamide 10 lbs. Fall (none applied 1934)
3	1.74	.89	1.14	1.25	Check*
4	2.79	1.74	2.28	2.27	Sulphate of Ammonia 5 lbs. Fall
5	1.91	1.32	1.25	1.49	Nitrate of Soda 6.5 lbs. Fall
6	1.36	1.19	1.38	1.31	Calcium Cyanamide 5 lbs. Spring
7	.89	1.18	.33	.80	Check
8	1.45	1.35	1.55	1.45	Calcium Cyanamide 10 lbs. Spring (none applied 1934)
9	1.80	1.23	.62	1.22	Calcium Cyanamide 15 lbs. Spring (none applied 1933–34)
10	.70	1.19	.30	.73	Check
11	1.09	1.59	1.41	1.37	Sulphate of Ammonia 5 lbs. Spring
12	1.19	.44	.39	.67	Check
13	5.31	2.91	1.75	3.32	Ammo-Phos.13 lbs.Spring (none applied 1934)
14	3.66	3.07	2.71	3.15	Ammo-Phos. Pot. 17½ lbs. Spring (none 1934)
15	1.19	1.39	.62	1.07	Check
			AVERAGE ANNUAL YIELD 1933–34		
FALL APPLICATION:					
16	3.75	2.75	4.00	3.50	Calcium Cyanamide 10 lbs. Acid Phos. (20%) 13 lbs., Sulphate of Potash 4.2 lbs.
17	4.13	2.07	2.69	2.96	Calcium Cyanamide 10 lbs. Sul. Potash 4.2 lbs.
18	4.44	2.63	2.44	3.17	Calcium Cyanamide 10 lbs. Acid Phos. (20%) 13 lbs.
19	1.82	.38	.57	.92	Calcium Cyanamide 10 lbs.
SPRING APPLICATION:					
16	5.50	2.25	4.00	3.54	Same as 16 above
17	4.00	1.07	2.44	2.50	Same as 17 above
18	4.22	2.38	2.44	3.02	Same as 18 above
19	1.88	.38	.57	.94	Same as 19 above

*Check = Unfertilized.

"Among the soils from die-back areas, one produced marked stunting of growth as well as leaf scorch, the first year the trees were planted. In another soil, no certain injury appeared until the fourth year, but from the fourth to the sixth year trees *have been increasingly affected*, showing definite leaf scorch as early as June ..... The heavy applications of potassium salts (in such a manner as to influence the whole mass) at the time of planting the trees completely prevented the appearance of leaf-scorch symptoms."

In orchards with lighter textured subsoils such as occur in the mountain coves and with the wider planting distances, there is more room for root development and consequent foraging for nutrient material. In such conditions apple trees are able to grow to relatively greater ages without showing any certain symptoms of definite nutrient deficiencies. Many of these trees planted in more favorable conditions of fertility and space may be exploited profitably for the greater part of their commercial life without the addition of any fer-

tilizers whatever. In Virginia in general such exploitation will not be altogether profitable. Most Virginia apple orchards at some time of their commercial life will need all three of the essential elements, namely, nitrogen, phosphorus, and potassium. This is clearly indicated in the results of the 24-year old station orchard at Blacksburg and those of the Price orchard in the near vicinity and of the same age. Both orchards are typical in most essentials of those found in Virginia. The results secured furnish a basis for scientific and practical information, not only for most orchards in Virginia but for those apple-growing sections adjoining.

Since the more outstanding responses that generally come from nitrogenous applications have not been so generally observed in apple orchards from potash applications, their full ultimate value may be overlooked. It would be well to be aware of certain symptoms caused by potash deficiencies and be prepared to make applications to prevent certain

TABLE III—AVERAGE ANNUAL CIRCUMFERENCE INCREASE

1931-1932-1933-1934

Dean Price Orchard

Row	Inches per tree: Grimes	York	Stayman	All Varieties	Treatment
1	.82	.95	.85	.87	Calcium Cyanamide 5 lbs. Fall
2	.82	.91	.82	.85	Calcium Cyanamide 10 lbs. Fall (none applied 1934)
3	.72	.65	.65	.67	Check*
4	.96	1.06	1.01	1.01	Sulphate of Ammonia 5 lbs. Fall
5	.99	.97	.96	.97	Nitrate of Soda 6.5 lbs. Fall
6	.94	.96	.93	.94	Calcium Cyanamide 5 lbs. Spring
7	.61	.67	.66	.65	Check
8	.93	.93	.63	.83	Calcium Cyanamide 10 lbs. Spring (none applied 1934)
9	1.05	.94	.84	.94	Calcium Cyanamide 15 lbs. Spring (none applied 1933–34)
10	.73	.76	.54	.68	Check
11	.90	.99	.88	.92	Sulphate of Ammonia 5 lbs. Spring
12	.73	.74	.65	.71	Check
13	1.17	1.27	1.30	1.25	Ammo-Phos.13 lbs.Spring (none applied 1934)
14	1.12	1.13	1.02	1.09	Ammo-Phos. Pot. 17½ lbs. Spring (none 1934)
15	.71	.69	.65	.68	Check
	AVERAGE ANNUAL CIRCUMFERENCE INCREASE 1932–1933–1934				
FALL APPLICATION:					
16	1.17	1.17	1.13	1.16	Calcium Cyanamide 10 lbs. Acid Phos. (20%) 13 lbs. and Sulphate of Potash 4.2 lbs.
17	1.33	1.17	1.13	1.21	Calcium Cyanamide 10 lbs. Sul. Potash 4.2 lbs.
18	1.09	.88	.92	.96	Calcium Cyanamide 10 lbs. Acid Phos. (20%) 13 lbs.
19	1.00	.59	.75	.78	Calcium Cyanamide 10 lbs.
SPRING APPLICATION:					
16	1.17	1.00	1.00	1.06	Same as 16 above
17	.96	1.00	.92	.96	Same as 17 above
18	.83	.67	.50	.67	Same as 18 above
19	.75	.83	.84	.81	Same as 19 above

*Check = Unfertilized

mal-effects that will eventually occur in the absence of sufficient quantities of this element.

Symptoms of potash deficiencies have been reported from various sources. A brief review of several reports will indicate how serious such deficiencies may be.

According to Davis and Hill of the Canada Department of Agriculture, those series lacking potash exhibited foliage of a good dark-green color until well into the fruiting season, but the plants were not as large nor as vigorous as the full nutrient solution plants. "The foliage gradually became dull, losing its lustre and by the end of the fruiting season the leaves began to curl considerably and exhibited a bronzing with considerable purple on the under side of the leaf. This color, by late summer of the first fruiting, had spread to the upper surface and occupied the entire margin of most leaves, with only the center showing green."

Garber of England shows, "In recent years the balance of the fertilizer

TABLE IV—Average Annual Terminal Growth—
1931-1932-1933-1934

Dean Price Orchard

Row	Inches per tree: Grimes	York	Stayman	All Varieties	Treatment
1	2.8	2.1	3.7	2.9	Calcium Cyanamide 5 lbs. Fall
2	2.3	2.0	3.2	2.5	Calcium Cyanamide 10 lbs. Fall (none applied 1934)
3	2.0	1.5	2.5	2.0	Check*
4	2.8	2.0	3.3	2.7	Sulphate of Ammonia 5 lbs. Fall
5	2.6	1.8	2.9	2.4	Nitrate of Soda 6.5 lbs. Fall
6	2.7	2.0	3.2	2.6	Calcium Cyanamide 5 lbs. Spring
7	1.7	1.5	1.9	1.7	Check
8	2.6	2.0	2.4	2.3	Calcium Cyanamide 10 lbs. Spring (none applied 1934)
9	2.9	1.7	2.4	2.3	Calcium Cyanamide 15 lbs. Spring (none applied 1933–34)
10	1.8	1.4	1.8	1.7	Check
11	2.1	1.4	2.6	2.0	Sulphate of Ammonia 5 lbs. Spring
12	1.5	1.1	1.8	1.5	Check
13	4.3	3.2	4.8	4.1	Ammo-Phos. 13 lbs. Spring (none applied 1934) (only half of trees fertilized 1933)
14	3.9	3.2	6.8	4.6	Ammo-Phos. Pot. 17¾ lbs. Spring (none 1934)
15	1.3	1.3	1.7	1.4	Check
	Average Annual Terminal Growth 1932–1933–1934				
Fall Application:					
16	3.5	2.1	3.5	3.0	Calcium Cyanamide 10 lbs. Acid Phos. (20%) 13 lbs., Sulphate of Potash 4.2 lbs.
17	4.2	2.6	5.0	3.9	Calcium Cyanamide 10 lbs. Sul. Pot. 4.2 lbs.
18	3.6	2.0	6.1	3.9	Calcium Cyanamide 10 lbs. Acid Phos. (20%) 13 lbs.
19	2.9	.9	1.5	1.8	Calcium Cyanamide 10 lbs.
Spring Application:					
16	2.6	1.3	2.4	2.1	Same as 16 above
17	1.6	1.0	1.6	1.4	Same as 17 above
18	1.6	.7	1.1	1.1	Same as 18 above
19	1.3	.7	1.2	1.1	Same as 19 above

*Check = Unfertilized.

treatment usually given to fruit trees has been called into question in connection with a trouble known as 'leaf scorch.' This consists of a browning of the edges of the leaves, and is associated with general unthriftiness and lack of vigor in the trees. *These symptoms have been shown to be related to deficiency of potash and excess of nitrogen* . . . the foliage of plots receiving very heavy nitrogenous dressings shows in the absence of potash a dying off of the margins of leaves very similar in general habit to the leaf scorch of fruit trees. . . . Where liberal use is made of nitrogenous fertilizers, the need for potash is therefore increased."

Gildehaus points out in the Botanical Gazette that it is well known that leaf scorch is a symptom of potash starvation, and this is verified in recent experiments. "The addition of a greater amount of potassium . . . greatly reduced the amount of affected foliage. The addition of an excess of potassium eliminated all scorching tendencies. Trees which were supplied with an excess of nitrogen were also found to develop a severe case of leaf scorch. When this amount of nitrogen was reduced to one-third, practically no scorch was developed. The results of these foliage observations seem to indicate that development of leaf scorch on apple trees is favored by a wide N/K ratio in the nutrient media. . . . In support of the absence of an adequate supply of potassium, the trees were unable to support the area of the foliage produced. This suggestion is supported by the fact that when production of large leaves is stimulated by the addition of nitrogen, leaf scorch which reduces the area of living foliage becomes more pronounced. Conversely, by reducing the nitrogen supply and consequently rendering the plant less vigorous vegetatively, the potassium supply appears to be adequate for the smaller leaves produced and leaf scorch does not appear."

Janssen and Bartholomew in the Journal American Society of Agronomy say they find there is an inverse relationship between the potassium and nitrogen content of the plant where there is insufficient potassium for normal growth.

Wallace of England mentions that it has been shown that potash deficiency in fruit trees is an extremely serious problem in the important fruit areas of this country. "As a result of such deficiency, fruit plants such as the apple, gooseberry, black currant and red currant exhibit the condition known as leaf scorch. . . . Trees on the nitrate of soda plots have been shown to be suffering from potash deficiency by treating a portion of the plot with sulphate of potash, the potash treatment having produced a marked growth response and resulted in the elimination of leaf scorch in three seasons. . . . A very large number of cases have been investigated and, in every one, it has been found that the healthy trees were high-potassium trees and the scorched trees of low-potassium content, thus showing the patchy nature of potassium deficiency in the field."

Grimes apple tree—No fertilizer.

Hoblyn, another English investigator, explains that the most important manurial information which has been obtained from his experiments with very different varieties is the necessity of having in soils a proper balance

between nitrogen and potash. For yield, nitrogen alone has been not only ineffective but inadvisable except in the presence of potash.

Experiments by the two Missouri investigators, Murneek and Gildehaus, show interesting results with groups of semi-dwarf apple trees which have been planted in quartz sand and loess soil in tubs. "These trees have been fertilized with increasing and decreasing amounts of nitrogen and potassium while the phosphorus content of the fertilizer has been kept constant. When the nitrogen was increased without a corresponding increase in potassium supply, marginal scorching of leaves was induced. Increasing its potassium content obviated this harmful effect of the fertilizer."

Above: Grimes apple tree—Nitrogen only.

Below: Grimes apple tree—Complete Fertilizer.

According to the more recent report of Shaw, of the Massachusetts Agricultural Experiment Station, nitrogenous applications to apple trees that were not doing so well seemed to injure rather than improve the condition of the trees. The observations suggested to this investigator that the leaf burn and general poor condition of the trees in this orchard may be due to lack of potash in the soil.

The effects of potash deficiencies upon apple trees are touched upon by Munson of the Maine Agricultural Experiment Station as early as 1908. He reports as follows:

"In August, when about the size of walnuts, the fruits (apples) began to crack and drop. Marked indentations, somewhat similar to those made by curculio, were abundant. No evidence of insect work could be discovered, however. When the fruit was opened, the tissue under the indented parts was found to be dry and brown. Most of the fruit ceased to grow, and by the first of September the larger part of it was on the ground; though early in the season all the trees were well loaded. . . . Though a small portion of the fruit was on the trees at harvest time, it dropped so easily that no attempt was made to save it for packing. The slightest jarring of the limbs caused it to fall. . . . It was then observed that the condition existed only on certain trees included in a fertilizer experiment in which an excess of available nitrogen is applied every year. The first tree noticed was in the plot which received nitrate of soda and acid phosphate, and later it was found that every tree on the plot, as also on the adjoining plot which received nitrate only, was affected as described. In one or two instances check trees which adjoined the nitrate plot, and received no direct application of fertilizer, showed a tendency in this direction. A fertilizer plot on which were muriate of potash and acid phosphate, and another on which was muriate only, separated from the first by only a single row of trees, were entirely free from this disease. . . .

The supposition was, therefore, made that the trouble was physiological and due to the excessive amount of available nitrogen and the lack of potash."

Several very striking observations suggesting potassic deficiency were found in the Price orchard, especially in the row of trees receiving heavy applications of ammoniated phosphorus. Some most interesting cases of cross-feeding into the next row treated with complete fertilizer only 25 feet away were found. On the side next to the unfertilized row, several marked symptoms were found in the ammoniated-phosphorus row the second season after the fertilizer applications were made. The symptoms showed up to a much less extent on the side of the row next to the one which received a complete-fertilizer application. Likewise these symptoms showed up also but somewhat less in that side of the check row next to the one that received only ammoniated phosphorus. The most outstanding symptom on those portions of the check trees cross-feeding into the ammoniated-phosphorus row next to the complete-fertilizer row was the earlier dropping of fruit. There was also a high prevalence of cork spotting and later of Sporotrichum malorum spots. (See plate II.) The variation of these symptoms in the ammoniated-phosphorus row on the side next to the completely fertilized rows was likely due to a certain degree of cross-feeding of some of the roots of the trees in the ammoniated-phosphorus row into the completely fertilized row. This seems a very logical conclusion because the row treated with complete fertilizer was almost free of these symptoms.

There is a very interesting connection between certain tissue malformation resulting in corked tissue and the absence of sufficient amounts of potash. This type of disorder is most frequently an aftermath of earlier dry, hot summer spells particularly in orchards underlain with rock or heavy impenetrable subsoils and in certain irrigated districts when a sufficient amount of water is not applied. This is also present during dry, hot seasons in root-crowded and heavy sod orchards.

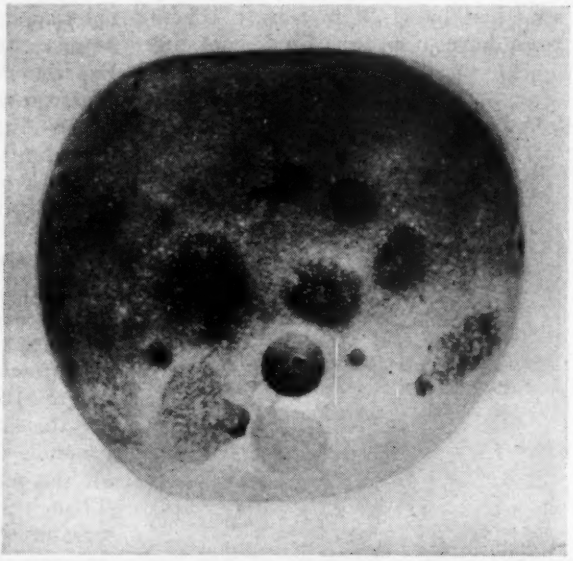

Plate II—Typical cork and Sporotrichum malorum spotting found on Grimes Golden apple trees not receiving potash applications. These two types of spotting were prevalent to the greater degree in plats fertilized with nitrogen and phosphorus without potash and noticeably less where potash was added or where there was evidence of cross-feeding into the potash plats.

Evidences of this histological disorder, though in a general way somewhat similar, may become localized and thus are often referred to by such various names as "drought spot," "cork spot," and "York spot." In these cases the corking penetrates the flesh of the apple in varying degrees. The term "crinkle" is also used with apples in which the tissues are more

or less "marbled" with corky cells causing a crinkled appearance on the apple.

During the dry spells mentioned, the potash intake is very likely slowed up to such a degree that even if it were present in sufficient abundance in the soil, it could not be taken up in adequate amounts. In seasons of abundant early summer rainfall, there is very little of this spotting, particularly in orchards that have been given potash manuring. This was brought out in the past season of 1934 for Virginia which was outstanding for a moist summer and for fruit of high finish and texture. Even in soils that have not been so liberally manured with potash salts, with an abundance of moisture there is some chance for a better distribution of the potassic material that may be reached. With adequate moisture facilitating a greater solution of the various salts, even in crowded orchards there is some chance of potassic materials coming in from unexploited areas to within the root-occupied soil areas. All this helps to contribute towards a better nutrient balance and, as consequence, a fruit of better finish and quality.

Keeping Quality

During 1933 and 1934 fruit was selected from apple trees treated with different fertilizer combinations. The selections were made from the following plots: 1-nitrogen only; 2-phosphorus and nitrogen; 3-nitrogen and potash; 4-nitrogen, phosphorus, and potash; and 5-check (no fertilizers). Ten lots were selected for each one of these treatments to be tested for pressure at 10 different periods from November to April. Each lot was so selected that each one had the same number of apples of the same size and the same degree of color and so that the comparison was on the same level except for the fertilizer treatment. In every case significantly higher pressure tests were found in those treatments which included potash over those in which this manurial salt was absent. The lowest percentage of breakdown occurred in the lots having the higher pressure tests and those coming from the plots which included potash as a fertilizer.

More Evidence

Recent results reported by Davis, of Canada, indicate the important bearing on the value of balanced fertilizers as an aid to better keeping quality of fruit. According to this worker it has been the general experience in his section that high nitrogen feeding and possibly high nitrogen and phosphorus feeding are the two greatest factors in destroying the keeping quality of apples. It has been found that the ill effects of high nitrogen can be overcome by the addition of potassium in so far as vegetation is concerned. The author makes special emphasis on impressing the fruit grower that a highly vegetative apple tree, making excellent growth and possessing good-looking foliage, is not necessarily capable of producing good-keeping fruit. Davis also presents some tabular evidence to show the value of nitrogen, phosphorus and potash balance. The per cent of spoilage from internal browning that he reports is as follows: 9 nitrate only—32 per cent; 9 nitrate and 6 slag—12 per cent; 3 nitrate and 6 slag—100 per cent; and 9 nitrate, 6 slag, and 3 potash—none. It is pointed out that where nitrogen has been fed alone, the spoilage due to core flush has been considerable, viz., 32 per cent; but that where nitrogen has been fed in conjunction with a reasonable amount of slag, this has been reduced to 12 per cent; where an excess of slag over nitrogen has been used, it has jumped to 100 per cent; and that where potash has been added there is a drop in percentage from the 12 per cent to no spoilage.

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Ladino pastures in the Oakdale, California, district carry 20 sheep per acre for 60-90 days twice during the season.

Ladino Clover *to the* Rescue

By M. E. McCollam

San Jose, California

MANY a heroic role has been played on the farming stage by clover. Throughout the world it has continually been making crop rotations more effective by improving soils and furnishing better forage.

California, at first thought, would seem an unlikely place to once more cast clover as a hero. Alfalfa has been the exclusively favored forage in this State for a long time. Clover seemed to be able to perform its wonders only in the more humid northern regions. The improbable has happened, however, and nowhere has there been a more sensational and thoroughly satisfactory clover performance given than in the community of Oakdale, California. In this particular case, the hero is one of the younger members of the clover family, economically speaking. Its first name is Ladino.

Ladino clover came to the United States from Italy years ago. It appears to be white clover's big brother, having the same creeping habit and the same white blossoms, but a much larger and more luxuriant growth. Ladino seed was distributed for trial all over the country, and it is still being tried each year in many different localities. In the West, Ladino found favor in the Twin Falls section of Idaho, and in some sections of Washington and Oregon. Finally, it is now well established in California and has given tremendous impetus to our interest in irrigated pastures.

At Oakdale, California, the Ladino

development is making progress that in telling sounds fantastic. This locality is the center of a large stock-raising industry and an irrigation district comprising 75,000 acres. Not very many years ago the community was in bad financial condition which was fast becoming worse. Alfalfa would not grow; grain crops were not particularly good; and feed became such an expensive item to produce that a steadily growing number of farmers faced failure. The dark future faced by the farmers was, of course, shared by the merchants and the bank.

Fortunately for the community the president of the First National Bank of Oakdale, Mr. W. Rodden, had enough practical farming experience to know what was wrong and enough vision to see that a high-quality, high-producing forage crop would change the whole picture. Ladino clover first came to Mr. Rodden's attention in 1928. He was quick to recognize the possibility of irrigated Ladino pastures in his district, and after the first trials, he knew that here was the plant that could rebuild his community. It takes plenty of effort and enthusiasm to establish a new crop and a new system of farming. Mr. Rodden set about his task, did the work well, and the crop "took hold." Ladino has now reached the stage where it is spreading out of its own momentum, and one sees many fields from 200 to 1,000 acres being prepared for seeding.

In preparing land for Ladino, no attempt is made to level the rolling land, because of the shallow nature of the soil. In such locations the land is smoothed over and contour checks constructed for irrigation. It is amazing to see some farms that are quite rolling, but where every square foot can be irrigated by means of ingenious ditching and contour checking. On fairly level land careful leveling is done, and narrow border irrigation checks constructed.

Ladino takes its water frequently in small doses. The total requirement of irrigation water, however, is no more, and probably less, than for

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Ladino clover—Unfertilized.

Ladino clover—Fertilized.

The Inquiring Mind *and the* Seeing Eye

By Dr. A. S. Alexander

University of Wisconsin

GERMANY has been the birthplace of many a man who, on coming to America, has more than "made his mark," especially in the field of chemistry and chemical research. Of these, it is our privilege this month to introduce to the readers of *Better Crops* Dr. Oswald Schreiner, who has earned an enviable reputation as Chief of the Division of Soil Fertility Investigations in the Bureau of Chemistry and Soils of the United States Department of Agriculture.

His parents brought him to Baltimore, Maryland, when he was but eight years old and at once gave him the benefit of a liberal education which in time developed in him to the highest degree those attributes of application, thoroughness, industry, and exactitude which have characterized so many scientists of his race, and enabled them to accomplish wonders in their chosen vocations.

Pleasure in Work

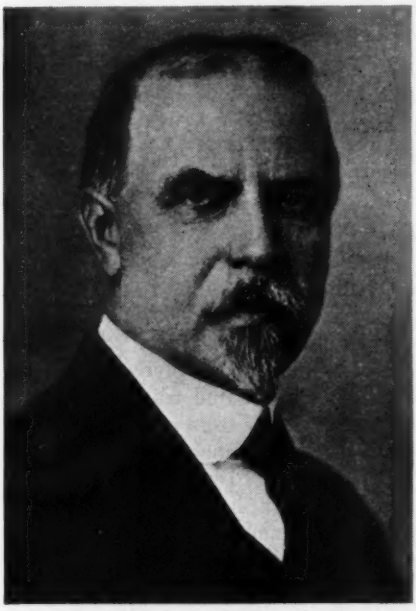
Work for the young immigrant proved a pleasure from the first, and being carried on in a congenial environment and encouraged by the kindly interest of all who recognized the inherent ability of the boy, he progressed apace and soon attracted attention. Destined to succeed and given facilities and efficient training in the land of his adoption, nothing could deter his progress, and when manhood's days were attained he had forged to the top and been given an opportunity usefully to exercise his genius for field and laboratory work in his chosen subject.

The amount and variety of work Dr. Schreiner has accomplished is stupendous and yet, today, he is not satisfied to rest from his labors but goes on, undaunted, tackling new projects and problems and as keenly as ever seeking their solution.

Achievements Are Many

A detailed category of his achievements would require much more space than is at our disposal, but a few of them may be recorded here. One of the notable ones has been the origination and introduction, with the aid of J. J. Skinner, of the "Triangle" or fertilizer ratio system to cope with soil fertility and fertilizer problems. This method has, for many years, been used in the Government soil fertility greenhouses and laboratories to study the effect of organic compounds isolated from soils and found either beneficial or toxic. Later, the Triangle method was made applicable to field work for determining the fertilizer requirements of prominent soil types over wide areas of the United States, including such crops as cotton, potatoes, sugar beets, sugar cane, and the citrus fruits, etc.

Details of the method were explained and illustrated in a paper on the subject presented by Dr. Schreiner at the Tenth Annual Meeting of the American Society of Agronomy, Washington, D. C., November 13, 1917, and printed in volume 10 of the Journal of that Society for September 1918. The presentation attracted great attention, and the system it described was regarded as a sufficiently comprehensive basis, with



DR. OSWALD SCHREINER

proper and careful attention to soil differences as far as they can be mapped in advance or in the course of the experiments, for the proper interpretation and easy presentation and handling of the results.

Dr. Schreiner's development of methods for determining water-soluble plant-food constituents also has been an outstanding feature of his scientific career and he has, further, made important studies, with his able assistants, covering the physiological relation of the so-called rarer elements to the health of plants and the human race. While modern research has been largely devoted to the study and application of nitrogen, phosphorus, and potash, it has been Dr. Schreiner's belief and contention that deficiencies of the rarer elements in soils and plants also can exist, so that there is good reason for the study of their role in plant and animal physiology, which is occupying the attention of many research men at the present time. Of these elements Dr. Schreiner mentions manganese, copper, boron, iodine, zinc, arsenic, barium, strontium, calcium, chromium, vanadium, aluminum, and silicon.

Dr. Schreiner is likewise noted as the inventor of the Schreiner colorimeter which, on account of its great applicability to various lines of research, is widely used in chemical laboratories in this country and abroad. His laboratory researches upon the fundamental principles of soil fertility, especially that relating to the chemistry and biochemistry of soil organic matter or humus, and its function in promoting or hindering plant developments, have won for him and his associates a leadership among soil scientists at home and abroad. To the Government laboratory, under his direction, belongs credit for the chemical discovery, physical separation, and plant physiological study of more than 50 new soil compounds, which have materially altered the fundamental conception of scientists regarding soil humus and its functions in crop production.

Winner of Prizes

The Ebert prize was awarded Dr. Schreiner in 1900 for chemical investigations on sesquiterpene hydrocarbons and derivatives, and also the prize of the American Pharmaceutical Association for chemical investigations on sesquiterpenes. In 1912 he received the Longstreet medal of merit for "important researches in agricultural chemistry" from the Franklin Institute. He is the author of many scientific papers on the chief

subjects he has studied and has been an attractive and instructive lecturer at agricultural colleges, clubs, and scientific societies and before Farmers' Institutes.

Among the many recent "jobs" undertaken by him is that delegated to him by Secretary of Agriculture Wallace at the request of the National Recovery Administration to represent the U. S. Department of Agriculture in all fertility grade reduction work, thereby providing for Federal cooperation with State Agricultural Authorities and the fertilizer industry at all hearings on this important matter.

War Service

Dr. Schreiner and his laboratory assistants also rendered eminent service to the government as chemists during the World War. This service consisted of organic chemical research and the preparation of some 20 rather unusual chemicals for the use of the gas warfare investigations, in cooperation with the American University Experiment Station; the preparation of several hundred pounds of organic chemical mannite necessary in the medical work of the army, in cooperation with the medical supply depot of the United States Army; the investigation of methods for the manufacture of metol, needed in the photographic work of the war, that led to the devising of the method for the preparation of this German chemical, which was registered as a public service patent.

He also worked on fertilizer matters connected with the utilization of by-products and excess products of the Ammonium Nitrate plant at Perryville, Md., in cooperation with the ordnance division of the army; investigations and reports on war fertilizers for sugar cane culture, especially as to the replacement of ammonium sulphate with sodium nitrate, in cooperation with the food administration and war trade board; cooperation with the national research council and the ordnance division of the army on various chemical matters; and utilization of excess war materials for fertilizers, in cooperation with the ordnance division of the army and the national research council.

He is the author of "The Sesquiterpenes" (1904); "Colorimetric, Turbidity and Titration Methods Used in Soil Investigations" (1906); "The Chemistry of Soil Organic Matter" (1910); "Lawn Soils" (1911); "Nitrogenous Soil Constituents" (1913); as well as numerous contributions to scientific journals.

On September 1, 1934, his division was transferred to the Bureau of Plant Industry.

Oswald Schreiner was born in Nassau, Germany, May 29, 1875, the son of Louis and Susanne (Volkert) Schreiner, who came to Baltimore, Maryland, in 1883. After preliminary studies in the local schools, he entered Baltimore Polytechnic Institute. He graduated from that school in 1892, and from the Maryland College of Pharmacy in 1894, with the degree of Ph.G. He was an honor student, having been awarded three gold medals for proficiency in chemistry. Thereafter he continued his studies in the graduate class of 1894-95 at Johns Hopkins University, and then at the University of Wisconsin.

Degrees at Wisconsin

In the latter institution he was a Research Fellow, 1895-96; Assistant in Pharmaceutical Technique, 1896; Instructor in that subject, 1897-1902, and Instructor in Physical Chemistry 1902-03. From the University of Wisconsin he received the degree of B.S. in 1897; M.S. in 1899; and Ph.D. in 1902. In 1902 he was married to Frances, daughter of Ralph McDougall Rector of Delavan, Wisconsin. They have two children,

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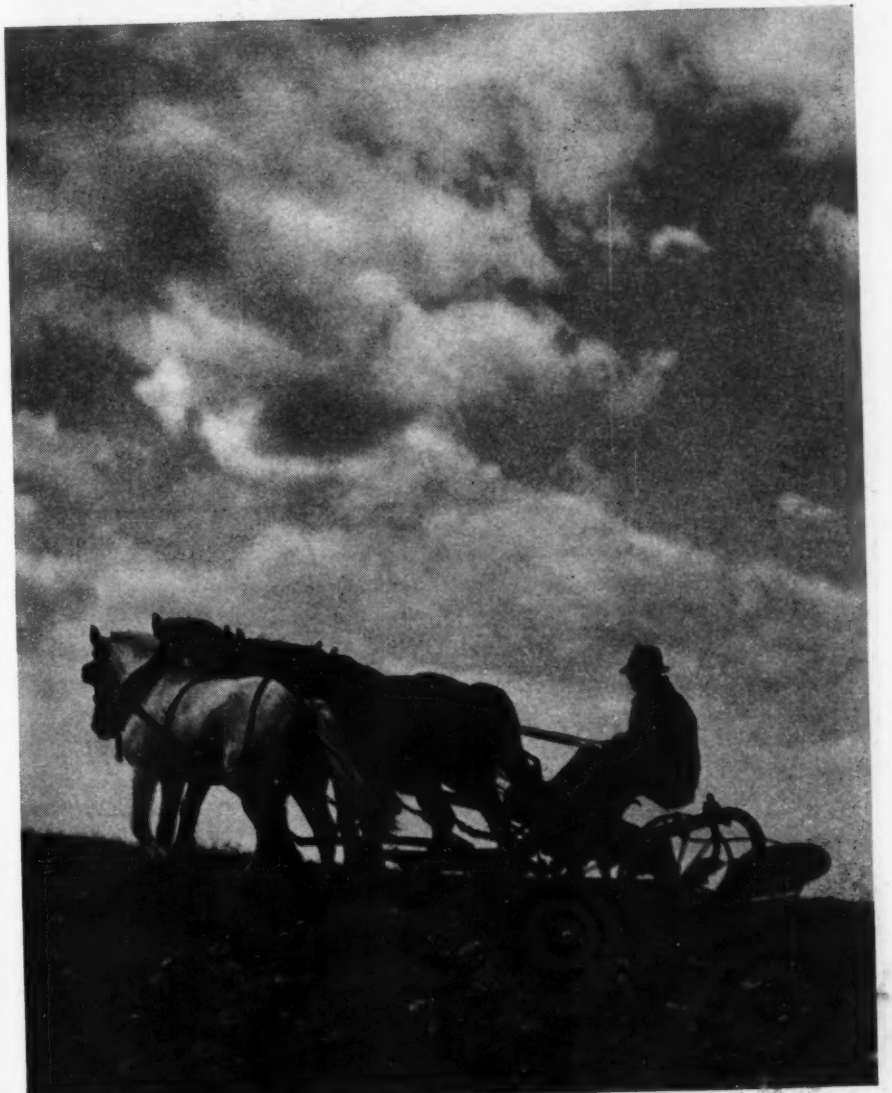
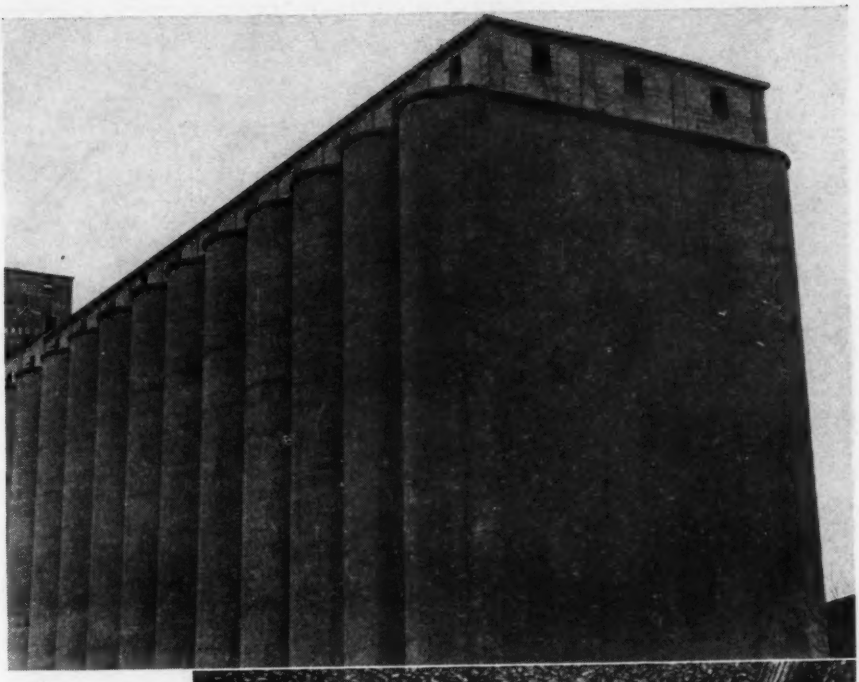
Pictorial



A PROGRESSIVE FARMER TURNS ARTIST'S MODEL.

Respite from Harvest Toils.



Symbols of the Ever-normal Granary.

Town and Country—School Days

The Editors Talk

We Shall Miss Them

Since our last issue, the life's work of three prominent men, well-known to our readers, has been completed. Well-earned were the fine tributes which have been paid them in the press and to them we can only add an expression of our own deep sense of loss—a loss occasioned not only by the passing of three notable and outstanding personalities, but by the cessation of three great sources of authoritative information and counsel based on long and fruitful years of experience and productive work.

Dr. Curtis F. Marbut, for many years Principal Soil Scientist and Chief of the Soil Survey Division of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, died on August 25 in the English hospital at Harbin, Manchuria. In spite of frail health and protests of friends, Dr. Marbut, after attending the Third International Congress of Soil Science at Oxford, England, at the request of the Chinese Government was en route to that country to make a study of the soils of China.

For 25 years Dr. Marbut had had supervision of the soil survey work of the U. S. Department of Agriculture, which has mapped approximately a billion acres of land, or about half the agricultural area of the United States. As a guide to farm practice, this inventory of soil resources is one of the most important parts in the scientific foundation of this country's program for agriculture. In addition, Dr. Marbut had examined and classified the soils in every country of western Europe, had directed the classification of the soils of Africa, and had made a study of the soils of South America.

In our April-May 1935 number, we were very pleased to present to our readers Dr. Alexander's tribute to the life work of Dr. Marbut. A strange coincident of fate willed that soon after sending us his article on Dr. Marbut, he too was called away.

Dr. A. S. Alexander died at his home in Madison, Wisconsin, on July 12. A nationally-known veterinary scientist, this beloved character was also a poet, an artist in water colors and oils, a scholar of original Greek and Latin, and a writer, whose writings over a period of 40 years in agricultural papers throughout the United States as well as for Scotch and English publications had won for him a large following.

For three years prior to 1890, Dr. Alexander was editor of the Farmer's Review, Chicago. With others he founded the Chicago Veterinary College where he served as professor of veterinary science and livestock breeding and feeding until 1907. He then went to the University of Wisconsin to fill the newly created chair of Veterinary Science, which he held until his retirement in 1930.

Dr. Alexander, already well-known to a great many of our readers, became a regular contributor to Better Crops With Plant Food in May 1930 when he started his series of articles, "The Inquiring Mind and the

Seeing Eye." These resumés of the life work and contributions to agriculture of outstanding scientists appealed so greatly to our readers that each subsequent issue of the magazine has contained one of Dr. Alexander's tributes. At the time of his death he was working on some in advance, and these we hope to have completed and published.

Quite as well-known in another field and particularly in the South was John S. Carroll, who passed away September 15 at his home in Jackson, Mississippi. For more than 30 years, Mr. Carroll had been associated with the potash interests in agricultural and scientific work. To think of potash in the South was to think of John Carroll with his gracious personality and sincere imparting of authoritative information on the practical use of this plant-food element.

Mr. Carroll's early training included the teaching of chemistry in the Mississippi Agricultural College and service as assistant State Chemist with work in connection with the Inspection and Analysis of Fertilizers. At the time of his death, he was manager of the Southwest Territory for the American Potash Institute.

And so we can but add our word to those of the countless others who will miss these men. They will not be forgotten. Work well-done, service for the betterment of humanity, memories of kindly personalities live long, and appreciation of their qualities grows with the years.

The Farmer's Partner

It has been said that the man who makes a partner of his soil, who strives to understand its mysteries and its peculiarities, is much more likely to be a successful producer of profitable crops than is the farmer who considers the soil but mere dirt, a slave to be driven without mercy.

Harvests are in. Yields are computed. The late fall days ahead provide an excellent time for the farmer to check up on his partner, the soil, and see if it produced in line with his expectations at the beginning of the growing season. Partners in their capabilities vary. Soils differ greatly in their characteristics. Yet a good manager knows his partner and his resources. A good farmer should make just as much of a study of his soil's productiveness.

Disappointments in harvest, within a farmer's means of control, should not be allowed to repeat. Expenditures for good seed, careful cultivation, sprays, etc., are expenses which the soil will waste if it does not naturally contain or is not provided with the plant food necessary to feed a quality crop. While the soil is now recognized as a living, vital, changing thing, it cannot fulfill orders unless it is equipped to do so. No more than a factory can produce beyond its capacity, can a soil grow crops for which it does not have the necessary plant foods.

The general recommendations of agronomists and soilsmen for the fertilizing of any particular crop or type of soil usually bring profitable returns. However, no two farms have soils which are entirely similar. Far more satisfactory results accrue when such recommendations are followed with a check-up of harvests against expectations. This is the time to do it.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture and the State Experiment Stations relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named

Fertilizers

An interesting series of experiments with different types and combinations of fertilizers when used in a rotation is summarized in Pennsylvania Agricultural Experiment Station Bulletin 315, "Field Experiments with Phosphates," by C. F. Noll, C. J. Irvin, and F. D. Gardner. As the title implies, the main object of the work was a comparison of different amounts and carriers of phosphates. However, the treatments were such that the effects of varying amounts of potash, the value of manure and nitrogen, and the influence of sulphur could be determined. Superphosphate and large applications of rock phosphate gave high net returns under the conditions of these experiments. Increasing the muriate of potash applications from 50 to 100 and 150 pounds per acre increased the yields in each case. The authors state: "It would seem that even a larger amount than 150 pounds per acre could be used profitably." As used in this work, nitrogen was not profitable. Manure, supplemented with phosphates gave good increases in yield, but when compared with commercial fertilizer, it was found to have a value of only $1.24 a ton in crop-producing ability. Gypsum and sulphur, added to rock phosphate, both increased yields over rock phosphate alone.

A handy and practical chart of fertilizer recommendations for Ohio has been prepared by R. M. Salter and E. Jones in Ohio University Agricultural College Extension Service Bulletin 136 entitled "Fertilizing Field Crops In Ohio." The amounts and analyses of fertilizers recommended for the most important crops of the state when grown on various soils in different types of management are tabulated. Other information and suggestions on the use of fertilizer are included in this handy publication.

Changes in the average fertilizer analyses used by farmers and in the average price per pound of plant nutrients in commercial fertilizer are shown by C. S. Cathcart in New Jersey Agricultural Experiment Station Bulletin 582, "Analyses of Commercial Fertilizer and Ground Bone; Analyses of Agricultural Lime, 1934." For example, the average nitrogen content of New Jersey mixed fertilizer increased from 2.94% in 1925 to 4.19% in 1934; available phosphoric acid increased from 8.41% to 9.25%; while potash increased from 5.77% to 6.88%. These figures show that farmers are using more concentrated fertilizers with relatively more nitrogen and potash than ten years ago. Fertilizers have become much cheaper during this period, as the average retail cost of one pound of plant nutrient was 11.0c in 1925, while it was only 7.2c in 1934. Other tables on tonnages and analyses of fertilizer and liming materials are included in the bulletin.

"Commercial Fertilizers, Agricultural Minerals," State Dept. of Agr., Sacramento, Calif., Sp. Pub. 132, 1934, *Dr. Alvin J. Cox.*

"Annual Report, State Chemist of Florida, 1934," *Dept. of Agr., Tallahassee, Fla.,* 1934, *Vol.* 44, *No.* 1, *J. J. Taylor.*

"Commercial Fertilizers for Potatoes in the Kansas River Valley," Agr. Exp. Sta., Manhattan, Kan., Cir. 174, *Feb.* 1935, *A. L. Clapp, H. E. Myers, and F. L. Timmons.*

"Fertilizers for Vegetable Crops," Agr. Exp. Sta., Columbia, Mo., Cir. 185, *Mar.* 1935, *R. A. Schroeder and H. G. Swartwout.*

"Availability of the Phosphoric Acid of Finely-Divided Rock Phosphate," Agr. Exp. Sta., College Station, Tex., Bul. 509, *June* 1935, *G. S. Fraps.*

Soils

Using the Neubauer seedling method, a mass of instructive data has been collected by S. F. Thornton and reported in Purdue University Agricultural Experiment Station Bulletin 399 entitled, "Soil and Fertilizer Studies by Means of The Neubauer Method." Details of carrying on soil investigations by means of the Neubauer method are given and precautions to be observed in using it and interpreting the results are included. The available phosphoric acid and potash in the surface soils of the variously treated plots of a number of experimental fields in Indiana are correlated with the treatments given, the acidity of the soil, and the crop yields produced. The amount of fertilizer added was so small that, in most cases, it had little effect on the available phosphoric acid and potash in the soil. Nearly every fertility plot in the state, regardless of the treatment, studied by the author contained insufficient phosphoric acid and potash for most field crops, judging by the standards he used. The crop yields on the plots in most cases reflect the low fertility levels of the soils. Results from an experimental field in Virginia on which heavier fertilizer applications were made showed that the available phosphoric acid and potash in the soil and corn yields were correlated with fertilizer treatment.

A large number of soils were grouped according to their range in acidity, to determine whether this had an influence on available nutrients in the soils. The data indicated that the more acid soils tended to have less available phosphoric acid and potash on the average. "However," the author states, "soils in any reaction range may be either very deficient in or abundantly supplied with either of these nutrients. With the method used no evidence is found that soil reaction may be used as an indication of fertilizer needs."

The proportion of added phosphoric acid and potash recovered by the rye seedlings was determined on a number of soil types from several states and Cuba. The results show that the amount of the added fertilizer recovered by the crop varied greatly with the different soils. Data are not complete enough to allow any classification of soils on the basis of the results obtained.

Liming an acid soil increased the proportion of added monocalcium phosphate (comparable to superphosphate) recovered by the seedlings. The recovery of phosphorus from tricalcium phosphate (rock phosphate) or potash from muriate of potash was not influenced by liming, on the soil used. Fineness of grinding rock phosphate did not appear appreciably to influence its availability.

It was found that muriate of potash increased the amount of phosphorus plants could obtain from each of the 22 different phosphorus carriers studied. The potash fertilizer also made more available the phosphorus in the 21 soils investigated. This was true for both the phosphorus already present in the soil and for that added as fertilizer.

The amount of available phosphorus and potassium in a large number of soils from several states was determined. The available phosphorus usually was somewhat lower in the subsoil than in the surface

soil. The same was true to some extent also for available potassium, but there were many exceptions with this nutrient. Consideration of the proportion of the soils deficient in these nutrients shows that, of the surface soils, 68% are deficient in phosphate and 49% deficient in potash, while 83% of the subsoils are deficient in phosphate and 51% deficient in potash, on the basis of Dr. Thornton's standards.

"Fit the fertilizer to the crop and soil as you would shoes to the feet" is a statement made by the Ohio Agricultural Experiment Station. Further confirmation of this quotation is made by J. B. Hester and F. A. Shelton in a report of an investigation of the fertility characteristics of three soils on the Coastal Plain of Virginia. The lime and fertilizer requirements of these soils differ widely owing to their differences in properties such as fixing power, organic matter contents, relative proportions of acids and bases present, etc. The data also show that the crop growth on the soils is strongly influenced by the degree to which the lime and fertilizer treatments conform to the peculiarities of the soils and make the necessary corrections. The work, published as Virginia Truck Experiment Station Bulletin 84, "Comparative Data for Three Coastal Plain Soils for Soil Characteristics and Plant Growth," is rather technical in nature but has an important practical application to soil management.

The instructive bulletin on the influence of various liming materials on the leaching of lime, magnesium, potash, nitrates, and sulphates from two soils in Tennessee and Virginia by W. H. MacIntire, W. B. Ellet, W. M. Shaw, and H. H. Hill, previously published as Bulletin 152 of the Tennessee Agricultural Experiment Station, has now been put out by the Virginia Agricultural Experiment Station as Technical Bulletin 54, entitled "The Conservation of Burnt Lime, Limestone, Dolomite and Calcium Silicate in Soil as Influenced by Methods of Incorporation." The work was carried on as a cooperative project by the two stations and the results are now available to the farmers of both states. Readers are referred to page 22 of the October-November 1934 issue of Better Crops With Plant Food for a review of this interesting bulletin.

The literature on rapid methods of testing soils has been enriched by Dr. M. F. Morgan's Bulletin 372, of the Connecticut Agricultural Experiment Station, "The Universal Soil Testing System." Three features of this bulletin are the large number of chemical constituents of the soil for which tests have been devised, a single extracting agent for removing all these constituents from the soils at one operation, and a closer correlation of the test results with the actual fertilizer and lime requirements of the crop and soil. The author gives detailed instructions for taking soil samples, preparing the various chemical reagents, and conducting the tests. Noteworthy are the suggestions relative to interpreting the tests. The crop to be grown, the kind of soil, and other pertinent factors are given consideration. The grouping of crops with respect to their lime, nitrogen, phosphoric acid, and potash requirements is interesting, and a helpful guide in itself in making fertilizer recommendations.

"The Use of Electrodialysis for Estimating Phosphate Availability in Calcareous Soils," Colo., Exp. Sta., Fort Collins, Colo., Tech. Bul. 12, *Feb.* 1935, *James B. Goodwin.*

"The Influence of Lime upon Soil Reaction and the Yield of Irish Potatoes," Reprint from "Transactions of Peninsula Horticultural Society," St. Bd. of Agr., Camden, Del., Vol. 24, *No.* 5, 1934, *Jackson B. Hester.*

"The Effects of Lime on the Hydrogen-Ion Concentration and Base Exchange Complex of Grundy Silt Loam," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 178, *Jan.* 1935, *R. H. Walker and P. E. Brown.*

"Utilization of Land Types for Fruit

Production, Berrien County, Michigan," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 257, Dec. 1934, J. O. Veatch and N. L. Partridge.

"Studies of Nitrogen Fixation in Some Michigan Soils," Agr. Exp. Sta., East Lansing, Mich., Tech. Bul. 143, Feb. 1935, L. M. Turk.

"The Influence of Soil Reaction (pH) on the Yield and Feeding Value of Hay," Agr. Exp. Sta., New Brunswick, N. J., Bul. 586, May, 1935, A. W. Blair, A. L. Prince, and S. H. Winterberg.

"Lime—For Soil Improvement," Agr. Exp. Sta., New Brunswick, N. J., Ext. Bul. 146, Nov. 1934, H. R. Cox.

"Classification and Agricultural Value of New York Soils," Agr. Exp. Sta., Ithaca, N. Y., Bul. 619, Jan. 1935, Frank B. Howe.

"Ecological Problems of the Humus Layer in the Forest," Agr. Exp. Sta., Ithaca, N. Y., Memoir 170, Feb. 1935, L. C. Romell.

"Ionic Exchange of Peat Soils," Agr. Exp. Sta., Ithaca, N. Y., Memoir 172, Feb. 1935, B. D. Wilson and E. V. Staker.

"Certain Rarer Elements in Soils and Fertilizers, and Their Role in Plant Growth," Agr. Exp. Sta., Ithaca, N. Y., Memoir 174, Apr. 1935, R. S. Young.

"North Carolina Soils Evaluated for Crop Growth," Agr. Exp. Sta., State College Station, Raleigh, N. C., Agronomy Infor. Cir. 94, June 1935, C. B. Williams and J. F. Lutz.

"The Soil Testing Service," Agr. Ext. Serv., Columbus, Ohio, Cir., Aug. 1934, F. J. Salter.

"Drainage and Irrigation, Soil, Economic, and Social Conditions, Delta Area, Utah" Agr. Exp. Sta., Logan, Utah, Bul. 255, Apr. 1935, O. W. Israelsen.

"Drainage and Irrigation, Soil, Economic, and Social Conditions, Delta Area, Utah," Agr. Exp. Sta., Logan, Utah, Bul. 256, May 1935, D. S. Jennings and J. Darrel Peterson.

"Seepage of Groundwater and Its Relation to Alkali Accumulation," Agr. Exp. Sta., Logan, Utah, Cir. 106, July 1934, D. S. Jennings, Willard Gardner, and C. W. Israelsen.

"The Rational Use of Lime in Potato Production in Eastern Virginia," Va. Truck Exp. Sta., Norfolk, Va., Bul. 83, Apr. 1934, Jackson B. Hester.

"Soil Survey of Jefferson County, Georgia," U. S. D. A., Washington, D. C., Series 1930, No. 26, R. T. Avon Burke, S. W. Phillips, J. W. Moon, R. Wildermuth, and A. L. Gray.

"Soil Survey of The Dixon Area, California," U. S. D. A., Washington, D. C., Series 1931, No. 7, Stanley W. Cosby and E. J. Carpenter.

"Soil Survey of Iowa, Crawford County," Agr. Exp. Sta., Ames, Iowa, Soil Survey Report No. 73, Mar. 1935, P. E. Brown, T. H. Benton, and H. R. Meldrum.

"Soil Survey of Mercer County, Kentucky," U. S. D. A., Washington, D. C., Se ies 1930, No. 23, H. W. Higbee, Yandal Wrather, and W. C. Boatright.

"Soil Survey of Knox County, Nebraska," U. S. D. A., Washington, D. C., Series 1930, No. 25, F. A. Hayes, E. A. Nieschmidt, L. A. Brown, B. J. Abashkin, R. L. Gemmell, R. H. Lovald, and H. Otte.

"Soil Survey of Tioga County, Pennsylvania," U. S. D. A., Washington, D. C., Series 1929, No. 30, B. H. Hendrickson, R. T. Avon Burke, K. V. Goodman, and R. L. Smith.

"Soil Survey of Collin County, Texas," U. S. D. A., Washington, D. C., Series 1930, No. 32, M. W. Beck, E. G. Fitzpatrick, and L. G. Ragsdale.

Crops

Of greatest interest among the publications which we classify under this heading is the new "Yearbook of Agriculture, 1935," which is the Secretary of Agriculture's report to the President. Articles of practically all phases of technical and economical research done in the U. S. Department of Agriculture appear in the volume. These articles are non-technical and cover a great variety of subjects. Topics receiving special attention include soil erosion, the eradication and control of insect pests, forest conservation, animal husbandry, and chemical investigations. Secretary Wallace, in his foreword, emphasizes the importance of organizing scientific research without destroying the spirit of free inquiry. The book may be obtained through Senators and Congressmen or from the Superintendent of Documents, Washington, D. C., at $1 a copy.

A new publication important to the sweet potato grower is Indiana's Extension Bulletin No. 204, "Sweet Potato Production." W. H. Ward, the author, discusses market preferences, suitable soils, fertilization, cultivation, and marketing, illustrating important considerations with splendid photographs. Growers of this popular tuber will benefit by adding this publication to their reference files.

"Forty-Fifth Annual Report for Fiscal Year Ending June 30, 1934," Agr. Exp. Sta., Auburn, Ala., M. T. Funchess.

"*Lima Beans,*" *Agr. Exp. Sta., Auburn, Ala., Leaf.* 14, *Apr.* 1935.

"*Date Growing in Arizona,*" *Agr. Exp. Sta., Tucson, Ariz., Bul.* 149, *May* 1935, *D. W. Albert and R. H. Hilgeman.*

"*Crested Wheat Grass for Dryland Pastures,*" *Colo Exp. Sta., Fort Collins, Colo., Press Bul.* 84. *Feb.* 1935, *M. S. Morris.*

"*Strawberry Growing in Colorado,*" *Colo. Exp. Sta., Fort Collins, Colo., Press Bul.* 86, *Apr.* 1935, *George Beach.*

"*Field Peas in Colorado,*" *Colo. Exp. Sta., Fort Collins, Colo., Bul.* 416, *Apr.* 1935, *Dwight Koonce.*

"*Rate of Planting Corn under Irrigated Conditions,*" *Colo. Exp. Sta., Fort Collins, Colo., Bul.* 417, *Apr.* 1935, *Warren H. Leonard and D. W. Robertson.*

"*Studies on the Critical Period for Applying Irrigation Water to Wheat,*" *Colo. Exp. Sta., Fort Collins, Colo., Tech. Bul.* 11, *Nov.* 1934, *D. W. Robertson, Alvin Kezer, John Sjogren, and Dwight Koonce.*

"*Tobacco Substation at Windsor, Report for* 1934," *Agr. Exp. Sta., New Haven, Conn. Bul.* 367, *Feb.* 1935, *P. J. Anderson, T. R. Swanback, and O. E. Street.*

"1934 *Report, Cooperative Extension Work in Agriculture and Home Economics,*" *Agr. Ext. Serv., Univ. of Fla., Tallahassee, Fla., June* 30, 1934, *Wilmon Newell.*

"*Rose Growing in Florida,*" *Agr. Ext. Serv., Gainesville, Fla., Bul.* 78, *Oct.* 1934, *W. L. Floyd and John V. Watkins.*

"*The Home Garden,*" *Agr. Ext. Serv., Gainesville, Fla., Bul.* 80, *June* 1935, *F. S. Jamison.*

"*Blackberries and Dewberries,*" *Agr. Exp. Sta., Univ. of Fla., Tallahassee, Fla., Press Bul.* 474, *Mar.* 1935, *Harold Mowry.*

"*Peach Culture in Georgia,*" *Agr. Ext. Serv., Athens, Ga., Vol.* 22, *Cir.* 253, *July* 1934, *T. H. McHatton.*

"*Sweet Potato Culture,*" *Agr. Ext. Serv., Athens, Ga., Vol.* 22, *Cir.* 254, *June* 1934, *R. L. Keener.*

"*Illinois Corn Performance Tests, Results for* 1934," *Agr. Exp. Sta., Urbana, Ill., Bul.* 411, *Feb.* 1935, *G. H. Dungan, J. R. Holbert, W. J. Mumm, J. H. Bigger, and A. L. Lang.*

"*Plant Forcing with Electric Light,*" *Agr. Exp. Sta., Lafayette, Ind., Cir.* 206, *Oct.* 1934, *Robert B. Withrow.*

"*Seventh Biennial Report of the Director,*" *Agr. Exp. Sta., Manahattan, Kan., Dec.* 1935, *W. E. Grimes, Acting Director.*

"*Annual Report for the Fiscal Year Ending November* 30, 1934," *Agr. Exp. Sta., Amherst, Mass., Bul.* 315, *Mar.* 1935, *F. J. Sievers.*

"*The Quarterly Bulletin,*" *Agr. Exp. Sta., East Lansing, Mich., Vol.* 17, *No.* 4, *May* 1935.

"*Sudan Grass,*" *Agr. Exp. Sta., Univ. Farm, St. Paul, Minn., Cir.* 45, *May* 1934, *A. C. Arny.*

"*The Relationship Between Certain Morphological Characters and Lodging in Corn,*" *Agr. Exp. Sta., Univ. Farm, St. Paul, Minn., Tech. Bul.* 103, *Aug.* 1934, *D. M. Hall.*

"*The Home Vegetable Garden,*" *Agr. Exp. Sta., Univ. Farm, St. Paul, Minn., Bul.* 315, *Jan.* 1935, *A. E. Hutchins.*

"*Seed Potato Production in Central Nebraska,*" *Agr. Exp. Sta., Lincoln, Neb., Bul.* 294, *Apr.* 1935, *H. O. Werner and L. L. Zook.*

"*The Greenhouse Culture of Carnations in Sand,*" *Agr. Exp. Sta., New Brunswick, N.J. Bul.* 588, *June* 1935, *H. M. Biekart and C. H. Connors.*

"*Pasture Management for High Quality Feed at Low Cost,*" *Agr. Exp. Sta., New Brunswick, N. J., Cir.* 351, *May* 1935, *Howard B. Sprague.*

"*Pumpkins and Squash,*" *Agr. Exp. Sta., New Brunswick, N. J., Ext. Bul.* 139, *Aug.* 1934, *C. H. Nissley.*

"*Carrots,*" *Agr. Exp. Sta., New Brunswick, N. J., Ext. Bul.* 140, *Sept.* 1934, *C. H. Nissley.*

"*Turnips and Rutabagas,*" *Agr. Exp. Sta., New Brunswick, N. J., Sept.* 1934, *Ext. Bul.* 141, *C. H. Nissley.*

"*For y-Fifth Annual Report,*" *Agr. Exp. Sta., State College, N. M.,* 1933–1934, *Fabian Garcia.*

"*Apple Growing in New York,*" *Agr. Exp. Sta., Geneva, N. Y., Cir.* 158, *Mar.* 1935, *G. H. Howe.*

"*Fifty-Third Annual Report,*" *Agr. Exp. Sta., Wooster, Ohio, Bul.* 548, *Apr.* 1935, *C. G. Williams.*

"*Sugar Acidity, and Juice Color Determinations in Grapes,*" *Agr. Exp. Sta., Wooster, Ohio, Bul.* 550, *July* 1935, *J. S. Shoemaker.*

"*The Bimonthly Bulletin,*" *Agr. Exp. Sta., Wooster, Ohio, Vol.* 20, *No.* 174, *May-June* 1935.

"*Annual Report for the Fiscal Year Ending June* 30, 1934," *Agr. Exp. Sta., Brookings, S. D., James W. Wilson.*

"*Summary Report of Progress, July* 1, 1932 *to June* 30, 1934," *Agr. Exp. Sta., Logan, Utah, Bul.* 250, *Sept.* 1934, *P. V. Cardon.*

"*Cherries of Utah,*" *Agr. Exp. Sta., Logan, Utah, Bul. 253, Feb.* 1935, *Francis M. Coe.*

"*Herbs—Their Culture and Use,*" *Agr. Ext. Serv., Burlington, Vt., Cir.* 83, *May* 1935, *Charlotte P. Brooks and Abbie Graham.*

"*Emergency Hay, Green Feed, and Pasture Crops,*" *Agr. Ext. Serv., Burlington, Vt., Brief.* 411, *May* 1935, *P. R. Miller.*

"*Department of Agriculture—Immigration of Virginia,*" *Richmond, Va., Bul.* 327, *June* 1935, *and Bul.* 328, *July* 1935.

"*Progress in Research at Reymann Memorial Farms,*" *Agr. Exp. Sta., Morgantown, W. Va., Cir.* 68, *Jan.* 1935, *G. A. Bowling.*

"*Growing Grapes in West Virginia,*" *Agr. Exp. Sta., Morgantown, W. Va., Cir.* 69, *Mar.* 1935, *H. E. Knowlton and W. H. Childs.*

"*Strengthening the Farmer's Position,*" *Agr. Ext. Serv., Madison, Wis., Cir.* 274, *Apr.* 1935.

"Fig Growing in the South Atlantic and Gulf States," U. S. D. A., Washington, D. C., Farmers' Bul. 1031, *Rev. Apr.* 1935, *H. P. Gould.*

"The Production of Cucumbers in Greenhouses," U. S. D. A., Washington, D. C., Farmers' Bul. 1320, *Rev. Mar.* 1935, *James H. Beattie.*

"Vegetable Seeds for the Home and Market Garden," U. S. D. A., Washington, D. C., Farmers' Bul. 1390, *Rev. July* 1927, *W. W. Tracy, Sr.*

"Pear Growing in the Pacific Coast States," U. S. D. A., Washington, D. C., Farmers' Bul. 1739, *Jan.* 1935, *C. F. Kinman and J. R. Magness.*

"Vetch Culture and Uses," U. S. D. A., Washington, D. C., Farmers' Bul. 1740, *Dec.* 1934, *Roland McKee and H. A. Schoth.*

"Cotton Diseases and Methods of Control," U. S. D. A., Washington, D. C., Farmers' Bul. 1745, *May* 1935, *David C. Neal and W. W. Gilbert.*

"Subsistence Farm Gardens," U. S. D. A., Washington, D. C., Farmers' Bul. 1746, *Feb.* 1935, *W. R. Beattie, J. W. Roberts, L. L. Harter, W. H. White, and D. L. Van Dine.*

"Workers in Subjects Pertaining to Agriculture in State Agricultural Colleges and Experiment Stations, 1934–35," *U. S. D. A., Washington, D. C., Misc. Pub.* 214, *Apr.* 1935, *Mary A. Agnew.*

Economics

Apple growers, widely distributed over the United States as home orchardists and concentrated in some sections as commercial growers, undoubtedly will be much interested in a new bulletin by the U. S. Department of Agriculture entitled, "Marketing Apples." Although this is listed as technical bulletin No. 474, there is much in the contents to interest the small grower. The development of the apple industry in the United States, producing regions, varieties, utilization of the crop, storage, and prices are some of the subjects treated in discussion and data by J. W. Park and R. R. Pailthorp, the authors, which will win for this publication a wide distribution.

"Part-Time Farming in Connecticut," Conn. State Col., Storrs, Conn., Bul. 201, *Mar.* 1935, *I. G. Davis and L. A. Salter, Jr.*

"Farmers' Cooperative Association in Florida," Agr. Exp. Sta., Gainesville, Fla., Bul. 276, *Mar.* 1935, *H. G. Hamilton and Marvin A. Brooker.*

"Cost of Production and Price," Agr. Exp. Sta., Univ. Farm, St. Paul, Minn., Sp. Bul. 166, *Aug.* 1934, *George A. Pond.*

"Factors Affecting Strawberry Prices," Agr. Exp. Sta., Columbia, Mo., Bul. 347, *Feb.* 1935, *F. L. Thomsen.*

"Missouri Farm Prices for 25 *Years," Agr. Exp. Sta., Columbia, Mo., Ref. Bul.* 221, *Mar.* 1935, *D. R. Cowan and F. L. Thomsen.*

"Montana County Organization, Services, and Costs," Agr. Exp. Sta., Bozeman, Mont., Bul. 298, *Apr.* 1935, *Roland R. Renne.*

"Farm Economics," N. Y. State Col. of Agr., Ithaca, N. Y., No. 90, *June* 1935.

"Costs and Returns and Factors for Success on Truck Farms on the New Truck Area of South Carolina," Agr. Exp. Sta., Clemson, S. C., Bul. 301, *June* 1935, *B. A. Russell and J. L. Fulmer.*

"Tax Delinquency on Farm Real Estate in Texas," Agr. Exp. Sta., College Station, Tex., Bul. 507, *Apr.* 1935, *L. P. Gabbard.*

"Cost of Producing Pears in Washington," Agr. Exp. Sta., Pullman, Wash., Bul. 307, *Apr.* 1935, *Chester C. Hampson and E. F. Landerholm.*

A "Punkin!"

A politician, addressing a group of farmers, wished to impress them with the fact that he was a farmer once himself.

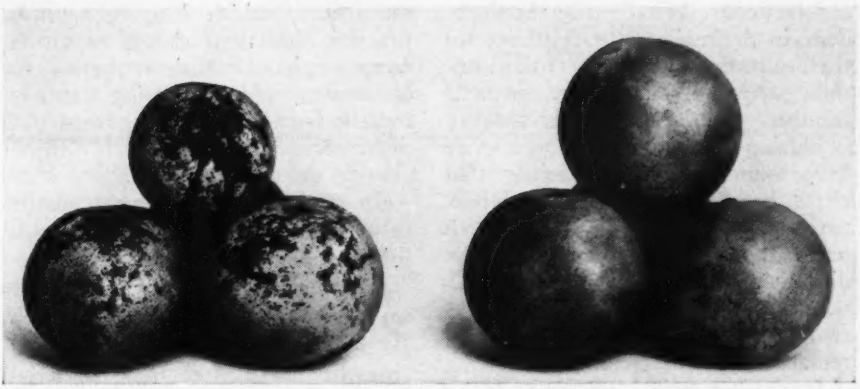
"Yes, sir," he said bombastically, "I was raised right between the corn rows as it were, and—"

"A punkin, by gum," an old farmer back in the crowd broke in.

Silence!

"But, my dear," bleated the poor little henpecked husband, "you've been talking for half an hour and I haven't said a word."

"No," snapped the wife, "you haven't said anything, but you've been listening in a most aggravating manner, and I'm not going to stand for it."



Note the difference in quality—Left: Grown with an unbalanced fertilizer; and, Right: Grown with properly balanced plant food.

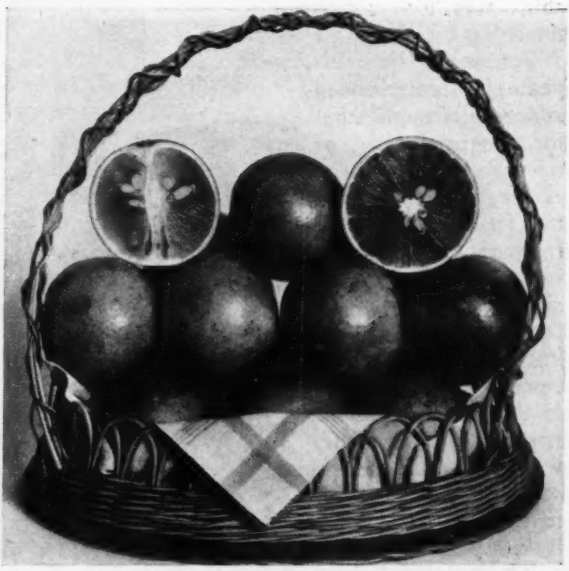
Quality Citrus

By C. W. Lyons

Tampa, Florida

THE question of fertilization of citrus trees in the production of good quality fruit has caused much comment and discussion, particularly when the grower felt the stress of economy on account of poor prices for his fruit. Up until five years ago practically all the fruit produced in Florida was grown from standard mixtures put out by various fertilizer companies. Later on through the same stress of economy, many growers found it necessary to reduce the application, and in fact some resorted to the use of straight materials in order to get along some way, feeling that they were doing the best that they could under the circumstances.

Doing the best that you can under circumstances, of course, is all that



Notice the quality produced by fertilizer analyzing 4-10-11 and 3-10-13 (NPK).

can be done. What really should be done in the make-up of fertilizer for the production of quality fruit is one thing and, of course, the financial condition of the grower is another.

During these last few years we have found out very definitely that citrus fruit requires adequate fertilization. Successive cropping of soils originally low in plant nutrients have depleted Florida soils of plant foods necessary for the growing of quality fruit. These nutrients can best be replaced by commercial fertilizer.

Beginning with nitrogen, great care must be exercised in the use of nitrogen or ammonia in the production of citrus fruit. Both trees and fruit develop very rapidly, and for this reason nitrogen, chemical and organic, should be on a balanced basis.

Phosphoric acid, procured from Florida phosphate rock treated with sulphuric acid and producing a 16 to 18 per cent available phosphoric acid, is a factor in the production of the seed and the rag of oranges and has some influence on early maturity under favorable weather conditions.

Potash as the sulphate is recommended as a general application for the production of citrus, this material playing a very important part in the texture of the fruit, its sweetness, and above all its carrying quality. In respect to the carrying quality, I find by tracing back the origin of the grove where the fruit is produced that where the fruit has decayed to a greater extent, there has been a lack of potash.

The successful citrus grower here works on the theory, which I agree with in practice, that there should be a sufficient supply of potash in the soil for the tree to feed on. Being a grower myself, we advocate a minimum of 8 per cent potash and preferably 10 per cent in the fertilizer.

In summing up the general quality of citrus fruit produced in Florida, in my opinion we have no choice in the matter as to what we should do in the production of quality fruit. By quality I mean the eating quality—the flavor that these materials tend to produce in fruit. It might surprise the average consumer to know that there is a wide variance in many instances as to the flavor of citrus fruit produced in Florida. We are constantly, through research and experiment, trying to develop a uniform flavor, and it is the consensus of opinion that this only can be accomplished by a uniform fertilization program embodying all the elements

A well-balanced tree as a result of well-balanced fertilizer has excellent fruit distribution.

that have been found necessary in the production of quality fruit.

Many programs through the application of economy have proven to be very expensive in the final analysis. In our own particular business it has been our recommendation to the grower at all times to use less fertilizer if it is necessary, but stick to the mixtures that would produce the quality. As many manufacturing concerns consistently advertise, there is no substitute for quality, and certainly this applies to the production of our citrus fruit if we want to maintain our markets.

Ladino Clover

(*From page* 19)

alfalfa. The soil structure of the soils around Oakdale is admirably adapted to the irrigation requirements of the clover. A rather heavy clay and a hardpan underlie the sandy loam soil at a depth of from 12 to 30 inches. This prevents excessive deep percolation and holds the light irrigations up in the surface soil in contact with the shallow-rooted Ladino.

Oakdale farmers were quick to accept the approved methods of intensive pasturing. Animals are rotated from one pasture field to another. Fields therefore are heavily stocked for short periods. This means efficient grazing.

The use of mineral fertilizers is accepted as a necessary procedure, because it is realized that such intensive pasturing draws heavily on the soil. At the present time superphosphate is the most extensively used fertilizer. This material has caused remarkable increases in the yield of clover. Superphosphate has been applied quite generally during the fall after the clover has become dormant, but there is some feeling that spring application when growth is starting would be better. The fall application seems to stimulate weed growth while the clover is dormant, causing the clover to be quite foul during the first spring grazing periods.

While no actual figures on yield of Ladino clover in terms of tons per acre are available, the yield of the fertilized stands must be tremendous. That fertilizer treatment pays a big profit is admitted by all, and it is generally said that after the second year of pasturing the use of fertilizer is absolutely necessary in order to maintain the clover's productiveness. A shallow soil, in which the plant is doing its feeding mostly in the surface foot, and the desirability of maintaining a highly productive pasture combine to make the use of fertilizer a subject of prime importance.

The growing of Ladino is so recent a development that little can be said as to length of life of the clover pastures. There are some fertilized pastures that are now six years old. Perhaps with good management and regular use of fertilizer, the pastures will last for many years. Under favorable conditions, in other localities, white clover has maintained itself in pastures for 30 years.

If you start to ask questions of Oakdale Ladino growers regarding the carrying capacity of the pastures, be prepared for statements which savor of "Paul Bunyan" yarns. While talking with Mr. Rodden in the bank, the writer popped the question on carrying capacity. The reply was 20 head of sheep per acre for 60 to 90 days, twice during the season. In other words this is 40 head

per acre. What would a stockman, who usually figures number of acres per head instead of number of head per acre, say to this? The writer did a little checking up with other growers and the story was the same. One stockman pastured 12,000 sheep on 300 acres during the season. Simple arithmetic brings us right back to our first authority. It looks like Oakdale has struck "green gold"!

Shade Trees Require Proper Fertilization

SHADE trees require food the same as shrubs, evergreens, flowers, or garden crops. They will develop properly if given a supply of food material and any additional care relative to thinning or pruning which may be necessary.

Shade trees will exhaust the food supply in the ground over a period of time. Root systems very often come very close to the surface of the soil in search of food, aeration, and water. Conditions detrimental to the growth of trees are threefold: famine, starvation, and suffocation.

Make Needs Known

Trees indicate their need for food when the following symptoms are shown: (a) leaves either brown, yellowish, or undersized; (b) thin foliage; (c) dead branches or tips of branches dying back; (d) short annual twig growth and undersized buds.

It must be remembered that a shade tree is an investment. It acts as protection and provides relief from the excessive sunlight. Insects and diseases often work havoc with trees. A thrifty growing tree can best fight its enemies inasmuch as its resistance will be high.

In planning for the fertilization of shade trees one must assume that the soil needs all of the elements necessary for plant growth. A fertilizer should be applied to the feeding roots of the tree which will be found beneath the drip of the branch spread. There is a perfect balance ordinarily between the branch system of the tree above ground and the root system below ground.

Trees may be fertilized at any time of the year provided only slow-acting organic materials are used. When chemical fertilizers are used they should be applied from March 1 to August 1. The seasonal growth of the tree is completed about the first of August.

Watering is just as important as feeding trees. The food must be in solution before a tree can make use of the fertilizer. It has been estimated that a tree with a spread of 50 feet will throw off through transpiration 30 barrels of water a day. In watering a tree the soils beneath the spread of the tree should be perforated and soaked to a depth of 30 inches. The water should be permitted to run for several hours at least once every two weeks.

When fertilizer is applied at the time the buds begin to swell, any good complete commercial fertilizer, 4-8-4, 4-12-4, or 5-10-5, can be applied at the rate of one-fourth to one-half pound to each one inch diameter of the tree. This fertilizer can be ap-

plied broadcast if the tree stands in bare soil and watered into the ground. If the tree stands in the lawn, holes 15 inches to 18 inches in depth should be punched to the outermost spread of the branches on an angle toward the roots. The fertilizer should be placed in each hole in proportion and water permitted to run slowly in the hole until the hole is filled; then the water should be permitted to run for a period of a couple of hours as mentioned above. The holes which are used around the roots of the trees should be spaced about 30 inches apart. Shade trees given the proper attention will produce luxuriant growth.

In experiments conducted at Cornell University it was found that a 10-20-10 fertilizer could be recommended at the rate of one-half pound per inch in trunk diameter. Since there are many types of fertilizer on the market for shade trees, the general rate of application may vary. Shade trees may be fertilized either in the fall or in the spring, however, preference is given to spring fertilization. In fall fertilization, applications should be made not earlier than September 1.

Canada's Prairie Provinces

GREAT progress in agricultural development has been witnessed in the Prairie Provinces of Canada during the last 35 years. During the years 1901 to 1931 the area of occupied farm land in the prairie region increased from 15 million acres to 110 million acres, or more than sevenfold. In 1901 the Prairie Provinces contained 24·3 per cent of the total occupied farm acreage in the Dominion and by 1931 this acreage had increased to 67·3 per cent of the total. In the same period the improved farm acreage increased from 18·5 per cent to 69·8 per cent and the field crop acreage from 18·2 per cent to 69·1 per cent. The decade 1901 to 1911 witnessed the greatest expansion, due to the rush of homesteaders into Saskatchewan and Alberta. Occupied farm land increased from 15 million acres to over 57 million acres. Of the improved land in the Prairie Provinces in 1931, 67 per cent was in field crops.

Farming in the Prairie Provinces comprises four more-or-less distinct types—wheat growing, mixed farming, dairying (usually associated with mixed farming), and ranching. Wheat growing predominates in southwestern and central Alberta, throughout the whole of Saskatchewan except the northern and eastern fringe and the dry belt, and in southern Manitoba, although in the latter area, the proportion of other cereals and forage crops is growing rapidly. Mixed farming is found in northern and western Alberta and in the northern and eastern parts of both Saskatchewan and Manitoba — in other words over practically the whole of the park belt. Mixed farming is also the dominant type in the irrigated districts. The greatest development in dairying has occurred in eastern Manitoba, northeastern Saskatchewan and northwestern Alberta. Ranching is practically confined to the dry area in southwestern Saskatchewan and southeastern Alberta and to a strip of land extending from the international boundary northward along the foothills to beyond Calgary.

Apple Trees Need Balanced Diet

(*From page* 17)

The results of the experiments from Virginia, together with those from Canada and Africa, point to the value of potash for better keeping qualities in apples.

On the whole more stress is generally laid upon the value of either phosphorus or potash to the cover crops particularly for the purpose of producing as heavy a growth as possible to be worked into the orchard soil as organic matter. Not so much thought is given to what direct benefits the apple tree itself might derive from such fertilizers.

Generally the cover crop response is the first to be observed as benefits from complete fertilizer application. With older and root-crowded trees, growth and yield responses have been found in the trees that are directly attributable to phosphatic and potassic applications. Excellent examples of such responses are indicated in the results secured in the Price orchard. (See tables I, II, and III.) In every instance where either or both phosphorus and potash were added to a nitrogenous carrier, very pronounced gains in growth and yields were obtained. The buds of the trees receiving a complete-fertilizer combination were almost four times heavier than those receiving only a nitrogenous application. These responses developed in the first season of application, thus showing how quickly apple trees may respond to a complete fertilizer.

Apple trees are more likely to show more direct and marked growth and yield responses to complete fertilizers as they become older and root-crowded. Responses have been observed with apple trees as early as their 17th year in the more favorable situations, as was brought out in the results presented earlier in this report. Outstanding results were shown in the Price orchard with trees at a more advanced stage of root crowding as soon as one season after application. Although responses were not observable until sometime after the 15th year in the more favored trees in the Station orchard, they nevertheless became manifest and showed with significance from then on.

In general, apple orchards of Virginia and in many sections adjoining are fairly well represented in most of their ultimate nutrient needs by the results secured either from the Station or the Price orchard. Even though a wide chemical variation exists, there are two physical factors that put most of the apple orchards on very much the same level. With the exception of some mountain cove orchards and perhaps some with deeper and lighter textured soils for root descent, the average orchards of Virginia have only between 2 to 3 feet of soil that can be penetrated by the roots of the apple trees. Coupled with this are the prevailing planting distances of the apple trees which over the State are of negligible variation. Thus on the whole, everything else being equal, the same varieties of apple trees over the State will all decrease in their rate of growth and yield when their root systems fill up their allotted soil areas to the degree of root crowding. From then on all of them will be on very much the same level. In 25 to 35-foot planting distances, all trees of the same variety after they are 20 to 25 years of age will come to much the same level of growth and yield rate decrease in such soils. The larger num-

ber of our Virginia orchards are just about at this stage at present. Most of them are now at a root-crowded stage.

Everything else being equal, all trees confined to a same space and degree of root crowding will respond to about the same degree to applications of nutrient salts in such depleted soils. In this way most of the apple trees in Virginia and its adjacent section can be fertilized on very much the same basis.

The value of potash in so far as improving the keeping properties of the fruit also should be considered. Apple trees fertilized properly with the three elements nitrogen, phosphorus and potash should in the end give the more profitable returns.

The Inquiring mind

(*From page* 22)

Louis Rector Schreiner and Oswald Schreiner, Jr.

In 1902 he became a naturalized citizen, and was appointed expert in physical chemistry investigations in the Bureau of Soils, U. S. Department of Agriculture, and became Chemist in 1903; Soil Scientist in 1904; and Chief of the Division of Soil Fertility Investigations in 1906. He continued in charge until 1915, when he was transferred to the Bureau of Plant Industry as Biochemist in Charge. On July 1, 1927, his division was transferred to the Bureau of Chemistry and Soils and in July 1928, Dr. Schreiner was appointed Principal Biochemist in Charge of Soil Fertility Investigations.

During this period he also found time to deliver many instructive addresses before Farmers' Institutes and Farmers' Clubs, as well as before Scientific Societies. He was lecturer in the Graduate Summer School in Agriculture, Ithaca, N. Y., in 1908, and at Lansing, Michigan, 1912, and rendered similar services at Columbia University, Cornell University, Michigan Agricultural College, Missouri University, Pennsylvania State College, Ohio University, Virginia Agricultural College, and the University of West Virginia.

Dr. Schreiner was Chairman of the American Organizing Committee of the First International Soil Science Congress, held in the United States in 1927; President of the Association of Official Agricultural Chemists in 1928; United States Delegate to the Fourth Pacific Congress and to the Third International Congress of Sugar Cane Technologists, both held in Java in 1921; Chairman of the Soils Committee for the Fourth International Sugar Cane Congress held in Puerto Rico in 1932; and he was elected Honorary Fellow in the American Society of Agronomy in 1929, in recognition of his scientific contributions to plant and soil chemistry. He is also a member of the American Association of Biological Chemistry; American Chemical Society; Washington Academy of Science; a Fellow of the American Association for the Advancement of Science; a member of the Botanical Society of America; and a member of Phi Beta Kappa and Phi Delta Chi. In 1930 he was elected a member of Sigma Xi by the Wisconsin Chapter. He visited the principal European research laboratories and experiment stations in 1899 and 1908, and has traveled in China, Cuba, East Indies, Japan, Malay, and the Philippines.

The field work of the division under Dr. Schreiner's charge has increased enormously since 1913. At that time it was practically confined to a single cooperative station at State College, Pa., in grass studies. Since then more than 20 field stations have been established, where soil fertility studies and fertilizer tests are carried out with potatoes, cotton, celery, lettuce, sorghums, corn, clover, pecans, citrus fruits, etc. This work is being conducted cooperatively with one or more of the offices of the Bureau of Plant Industry, agricultural experiment stations, or other state institutions, county organizations, and farmers. The inauguration of this work has involved much organizing ability, leadership, and cooperative spirit on the part of Dr. Schreiner and his co-workers, and the results of the experimental work are everywhere appreciated because of the direct practical application to local problems as well as the scientific value to the study of soils, fertilizers, and plant nutrition.

Authentic Library

Studies of the so-called "potash hunger" and related malnutrition disease and of the injuries done by borax in fertilizers have been successfully carried out, among other subjects, with results of direct value to farmers and fertilizer men. A system of experimentation with fertilizer salts has been devised, and new lines of leadership in investigation are being established. The publications of the Office of Soil Fertility form an authentic library of great scope and practical and scientific value.

Cooperative soil fertility and fertilizer field work also has been done at Presque Isle, Maine; Riverhead, Long Island, N. Y.; State College, Pa.; at Holmdel and New Brunswick, N. J.; Arlington Farm and Norfolk, Va.; New Bern, N. C.; Florence, Darlington and Pee Dee, S. C.; at Americus, Athens, Pecan City, Putney, Cairo and Dewitt, Ga.; Scottsburg, Ind.; Ashland, Wis.; Sheridan, Wyo.; Alma, Ark.; and at Monticello and Sanford, Fla.

Our readers will be interested to know that in a paper presented at the Second National Fertilizer Conference, held in West Baden, Ind., September 5 and 6, 1928, Dr. Schreiner suggested, first, a national unification and coordination of soil fertility and fertilizer experiments by the State Experiment Stations and the U. S. Department of Agriculture along regional lines, based on soil, climate, and crop characteristics; second, the establishment of one or more super-stations with exceptional facilities for the scientific study of fundamental factors connected with soil fertility or fertilizer investigations; and, third, the founding of an Institute of Fertilizer Research for solving the industrial problems directly connected with the manufacture of fertilizers.

Nine Regions

For the purposes of a national program of fertilizer investigations, he proposed to divide the United States into nine regions, viz., 1—The New England States (Maine, N. H., Vt., Mass., R. I.; and Conn.); 2—The Middle Atlantic States (N. Y., Pa., N. J., Del., Md., Va., W. Va.); 3—The Southeastern States (N. C., S. C., Ga., Fla.). He then grouped other states as follows: 4—(Wis., Mich., Ill., Ind., Ohio, and Ky.); 5—(La., Miss., Ala., Tenn.); 6—(N. D., S. D., Minn., Neb., Ia., Kan., Mo.); 7—(Okla., Ark., Tex.); 8—(Idaho, Mont., Utah, Wyo., Col., N. Mex., Ariz.); 9—(Ore., Wash., Nev., Cal.).

Relative to the action of fertilizers on soils, which is a much disputed question, Dr. Schreiner holds that the weight of evidence is against the assumption that their effect is due altogether to the increase of plant food as such. If so simple an explan-

ation were the true one, nearly a century of investigation of this problem by scientists of all civilized nations would surely have produced greater unanimity of opinion than now exists in regard to fertilizer practice.

Thoughtful investigators everywhere are finding that fertilizer salts are influencing many factors which contribute toward plant production besides the direct nutriment factor for the plant. It is this additional influence of fertilizers, according to Dr. Schreiner, which makes them doubly effective when rightly used and inefficient when improperly used. To this influence of fertilizers on soil, and biological conditions, is due their capriciousness when applied on the theory of lacking plant food, and any study which throws further light upon the mooted question will be a direct help toward reaching that view of soil fertility and soil fertilization which will eventually result in a more definite, more rational, and more remunerative fertilizer practice than in the past, and thus bring about the more extensive use of fertilizers in agriculture.

Toxic Secretions

Experiments by Dr Schreiner and his assistants have shown, we note, that healthy growing plants excrete from their roots substances which have a deleterious effect upon the growth of the root and that are especially toxic to plants of their own species. They conclude that: "The production of toxic secretions by the roots of the higher plants appears to afford an explanation of some of the important phenomena connected with association, invasion, and succession of plants. It is no less important as an explanation of certain underlying principles in agriculture, chief among which are those of crop rotation and productivity of the soil." An experiment made by him in 1907 also showed that while plants alone and fertilizer substances alone were able to accomplish a partial destruction of the toxic substances in soil, the combined action of plants and substances, ordinarily employed in fertilizers, caused a much greater destruction of toxic material and consequently an improvement in plant growth.

Dr. Schreiner and Dr. J. J. Skinner in 1910 proved that an organic soil constituent, dihydrostearic acid, hinders the growth of wheat plants when it is present in solution in pure distilled water, and also in the presence of nutrient or fertilizer salts in all ratios of fertilizer elements.

Minor Elements

Experiments on a highly calcareous soil in Florida demonstrated beyond all doubt that, whatever the fundamental function of manganese may be, the element is indispensable to the normal growth of tomato plants under conditions prevailing in that soil. It was found, too, that heavy applications of organic fertilizer could not meet the deficiency of man ganese in the soil. However, farmyard manure apparently carried sufficient manganese to supply the demands of the plants.

Dr. Schreiner has deemed iodine of some importance, seeing that it occurs in some of the salt deposits used as fertilizers, notably so in sodium nitrate; but whether this iodine in a fertilizer is of economic importance is a debatable question upon which more evidence is needed. According to Von Wrangell, the iodine does not increase the yield of plants sufficiently to warrant its addition to fertilizers in goiter-affected regions, and it was thought best to rely upon the selection of suitable food-stuffs to supply the necessary iodine for body use.

As to the employment of nitrogen in farming operations, Dr. Schreiner stated in 1911 that the chief aim has been to convert it into nitrates,

an operation which is far from simple, especially by distinctly chemical processes. His researches at that time were very suggestive of the fact that for agricultural purposes it may not be necessary to convert all nitrogen into nitrates, but that nitrogen of waste nitrogenous material in the industries can be converted into certain compounds, and so make available to agriculture much nitrogen now lost because of the difficulty in converting it into nitrates. His Bulletin No. 83 demonstrated that a nitrogenous constituent, creatine, which exists in soils, manures, and in many plants and seeds, and had been previously recognized only in connection with products of animal origin, is also beneficial to crops and that it seems able to replace nitrogen in aiding plant growth.

Oxidation in Soil

In Dr. Schriener's Bulletin No. 56 of 1909, the farmer is informed that the progress of oxidation by roots is largely, if not entirely, due to the activity of peroxidase produced by the roots. This oxidizing enzyme is most active in neutral or slightly alkaline solutions. The activity of the enzyme may be inhibited by the presence of acid and also by the conditions in solutions where putrification processes occur. This oxidization by roots has considerable agricultural interest, since processes promoting oxidation play a large part in the best methods of soil cultivation by tillage. This oxidation, in the soil, as shown by Dr. Schreiner in his bulletin No. 73 of 1910, is parallel to oxidation in plants and animals, and all the various kinds of oxidation going on in these undoubtedly can be duplicated by a detailed study of oxidation in soils. Whatever decreases the oxidation in soils tends also to bring about the conditions which decrease growth, and the factors which favor oxidation are the factors which favor soil productivity.

In Bulletin No. 53 of 1909, by Dr. Schreiner, the work reported also furnished a simple, tangible proof of the presence of injurious organic compounds in soils. In it he described four organic compounds he had isolated, all of which were well-defined crystalline bodies. One of them was pronounced quite injurious, one slightly harmful but not related to much more harmful compounds, and two were not harmful, so far as wheat seedlings used in the tests were concerned. In addition to these there had been isolated a number of other well-defined crystalline bodies.

Helpful Counsellor

The results and scope of the investigations of Dr. Schreiner's office are large and varied. His total number of contributions to science are upward of 90 articles, papers, and bulletins; and the total number of original contributions resulting from the scientific research work of the Office of Soil Fertility Investigations has been exceptionally large, indicating industry, ability, efficient organization and cooperation among its personnel. Credit for the work is shared with Dr. Schreiner by Dr. E. C. Shorey, Dr. J. J. Skinner, Bailey E. Brown, and Lewis A. Hurst.

Dr. Schreiner, we are informed by Mr. Brown, has been a helpful counsellor to many soil scientists who have gone out to make a mark in the scientific or commercial world. Of these may be mentioned Dr. H. S. Reed of the Citrus Experiment Station, Riverside, Calif.; Dr. M. X. Sullivan, Director of Chemo-Medical Institute, Washington, D. C.; Dr. E. C. Lathrop, Technical Director of the Crown Willamette Paper Co., Camas, Wash.; Dr. Rolla M. Harger, Professor of Biochemistry, Indiana University School of Medicine; and Dr. L. E. Wise, Professor of Forest Chemistry, University of

Syracuse, New York. In his capacity as Counseling Professor of Chemistry in the American University, he also has been a help and inspiration to many students aspiring to advanced degrees. They are unanimously appreciative of his assistance and frequently consult him about their problems.

Withal, he willingly takes his coat off and goes to work, whether on committees or in the field, even to the digging of potatoes in a North Carolina experimental plot on an exceedingly hot day. In his younger days he played tennis to keep him trim, and of late he has taken great interest and found real enjoyment in the growing of fine delphiniums. Another hobby has been the collecting of alchemical symbols.

Dr. Schreiner's life work has been monumental and his achievements praiseworthy in his line of effort. He still is active and as busy as ever, has attained a commanding position in his profession, and so is well worthy of applause and esteem. Palmam qui meruit ferat. (*Let him who has won it bear the palm.*)

All's Fair

(*From page* 6)

"little snips,"—the way they can take old flour sacks, a few yards of cheap calico, and other odds and ends and snip them with capable scissors into the nicest garments, with the neatest French (and other linguistic) seams you ever saw on a Paris gown. The lads of my time stood wistfully on the outskirts at fairs and seldom got into real training or met each other in anything but wrestling or pie-eating contests.

So gradually, by standing around, they sort of got the same perspective on farms and farming that the sideshow people had acquired. It seemed to one who merely watched it, to be a futile fumble, a weary old repetition of moss-grown stunts with the weather-man, the middle-man, and the mortgage-man as chief directors. When things got thicker around home, they envied these wandering minstrels and fair fakirs; and finally came the exodus.

But today you can check over the premium files of your county or district fairs a few years back and behold, the 4-H exhibitors and winners of those yesterdays are the ones who are now pressing electric buttons on the farms instead of punching time-clocks in some far-off hive of urban industry.

Yet even before the 4-H clubs came to save our generation from ennui and gloom, the far-sighted agricultural colleges and crop-improvement associations joined hands to conjure up dynamic, dramatic, and purposeful prods to a slothful agriculture through modern expo experiences. To be sure, their first poor charts and "befores and afters" smacked of Doctor Munyon's Peaceful Panacea, but exhibit technique soon profited by its early errors, and, led by the ingenious corps of craftsmen at the Federal Department of Agriculture, these fair features grew to a leading informational force. They *had* to improve or else retire completely from the lot and let the clowns and cheap jacks grab the show. Just as the wisest churches installed something modern and lively to hold the crowds, so have the educational forces of fairdom been obliged to unbend in dignity a trifle and release some human feelings.

Thumb through the catalog of a modern fair and see what a crossroads it has become. Every social, athletic, fraternal, and political interest has seized upon these hours of rural recess to pin their respective banners to the boards. Poor old baseball has been out-maneuvered by kitten ball, log-rolling, horseshoe-pitching, diaper-pinning, checker tourneys, bridge feuds, hobby contests, husband-hooting, hog-calling and dog-racing, not to omit auto-wrecking and air-stunting. Up, down, and sideways goes the weary head of the perspiring patron, trying to get his money's worth.

Probably it is more fatiguing to attend the modern exposition than it used to be when the bass drum and the homesick calf were the chief noise-makers on the grounds. But Americans are a hardy race, and being radio-toughened, they can stand any audible combination with the "greatest of ease." When you are thoroughly frazzled out it's a sign you have had a real nice day of it. Furthermore, you will remember the fair man's bumper corn formula by the size of the bunions you acquired.

Critics explain in my state that we have too many fairs, all duplicating each other and taking money away from folks who should use it for fuel and taxes. They would cut down our number of fairs from eighty-odd harvest shows to one in each "relief district" or rural resettlement zone," or something equally hypothetical. Too much gadding about is bad for tempers and tires, they say, and it costs too much in "bribes" to judges. Why not all go to the state fair or else wait for the coming Post-New-Deal world's exposition?

Like the arguments about the constitution, they say our weedy old fair parks belong to the horse-and-buggy days and so deserve to be regulated into behavior or relegated into oblivion. They argue that the unpaid premiums and the interest on the dilapidated buildings would build a new insane asylum or something.

No doubt these efficiency experts are right, but the state aid going to all these fairs is distributed by keen local politicians, and nobody ever puts the "previous question" after they debate it, so it never gets to a vote. After all, efficiency and a good time seldom move in the same orbit, so we still have our numerous fairs on our hands. The best way to glean the value of all fairs is to picture our country without any.

After the last mow is filled and the final autumn furrow is turned, we are faced with a period of pause before the ice king's coming, in which to check up on each other and the state of agriculture in general. In the absence of any fairs we should be obliged to do a lot of telephone rubbering, bulletin reading, and newspaper and magazine culling to get any tangible line on things which deeply concern us. Of course, there might be one grand radio fair at Rockefeller Center where you would be taken around under able guidance to see the wonders that have been, that are, and that may be.

BUT I am sure no such artificial substitute for a jovial, comfortable, sweaty old time on the midway and in the hall of horticulture would be acceptable to us chaps from the silo sections. We want our fairs served up in the genuine way, and we think we could get along without almost anything else but.

In fact, I am so "sot" on the subject of fairs that when I get too old and grizzly to continue as an office ornament, it will be my ambition to write a tremendously thick book called the History and Mystery of Fairs in America. If you care to subscribe in advance so that I may warn my publishers, just leave your names at the box-office.

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NO FOOLING

If a fellow tries to kiss a woman and gets away with it, he's a man; if he tries and doesn't get away with it, he's a brute; if he doesn't try but would get away with it if he tried, he's a coward; but if he doesn't try and wouldn't have gotten away with it if he tried, he's wise.

Man (to small son of one of his workmen who has met with an accident): "When will your dad be fit for work again?"

Boy: "Can't say for certain, but it will be a long time."

Man: "What makes you think that?"

Boy: "'Cause compensation's set in."

FREE WHEELING

An old Indian came to town one day, and for the first time he saw a man riding a bicycle.

"Huh!" he exclaimed, "White man heap lazy. Sits down to walk."

City Girl: "And I suppose at dusk, when the sun is stealing over the Rockies in purple splendor, you cowboys are huddled around the campfire broiling venison and listening to the weird, eerie, unnatural howlings of the coyotes."

Rattlesnake Gus: "Well, ma'am, not ezzackly. Usually we go inside and listen to Amos and Andy."

CONFESSION

One of Levinski's customers was notorious for his slowness in meeting liabilities. In desperation Levinski sent the following letter:

"Sir: Who bought a lot of goods from me and did not pay? You. Who promised to pay in sixty days? You. Who didn't pay in six months? You. Who is a thief, liar, and scoundrel?

"Yours truly,
"Al Levinski."

Little Rosalie, a first-grader, walking with her mother, spoke to a small boy. "His name is Jimmy and he is in my grade," she explained.

"What is the little boy's last name?" her mother asked.

"His whole name," said Rosalie, "is Jimmy Sitdown—that's what the teacher calls him."

Jackson: "I noticed you got up and gave that lady your seat in the tram the other day."

Hackson: "Since childhood I have respected a woman with a strap in her hand."

ONLY FOOLING

Rastus and Miranda were strolling through the cemetery, when Miranda called to Rastus, "Oh Lordy! come here see what that says! 'Not dead, but sleeping.'"

Rastus: "Sleep on, big boy, you ain't fooling nobody but yourself."

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90-95% KCl

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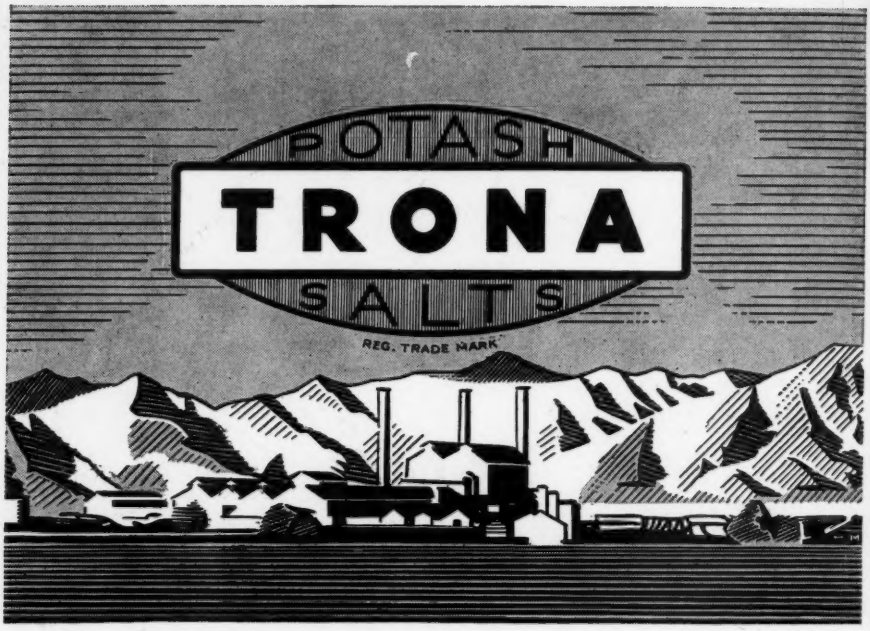

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